

# Transportation Energy Data Book

## 30<sup>th</sup> Edition



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# Transportation Energy Data Book

## Quick Facts

### Petroleum

- The U.S. produces 7.5 million barrels of petroleum per day (M bpd), or 9% of the world's 82.43 M bpd.
- The U.S. consumes 19.15 M bpd, or 22.5% of the world's 85.26 M bpd.
- U.S. transportation petroleum use is 69.7% of total U.S. petroleum use.
- U.S. transportation petroleum use is 172.5% of total U.S. petroleum production.
- Petroleum comprises 93.2% of U.S. transportation energy use.
- Cars and light trucks account for 64% of U.S. transportation petroleum use.
- Medium trucks account for 4% of U.S. transportation petroleum use.
- Heavy trucks account for 17% of U.S. transportation petroleum use.

### Energy

- U.S. transportation energy use accounts for 28.1% of total U.S. energy use.
- 99% of ethanol consumed in the U.S. is consumed as ethanol in gasohol (or "E10").
- Cars and light trucks account for 60% of U.S. transportation energy use.
- Medium trucks account for 4% of U.S. transportation energy use.
- Heavy trucks account for 18% of U.S. transportation energy use.

### Light Vehicle Characteristics

- There are 134,880,000 cars and 100,154,000 light trucks in the U.S. (235,034,000 total light vehicles).
- U.S. cars:
  - 5,635,000 cars were sold in 2010.
  - The average age of a U.S. car is 10.6 years; the average car lifetime is 16.9 years.
  - The average fuel economy for the U.S. car fleet (all cars on the road today) is 22.5 mpg.
  - Cars comprise 48.8% of new light vehicle sales.
- U.S. light trucks:
  - 5,919,000 light trucks were sold in 2010.
  - The average age of a U.S. light truck is 9.6 years; the average car lifetime is 15.5 years.
  - The average fuel economy for the U.S. light truck fleet (all light trucks on the road today) is 18.0 mpg.
  - Light trucks comprise 51.2% of new light vehicle sales.
- There were 8,030,000 fleet vehicles in 2009: 3,844,000 cars and 4,186,000 trucks.
- U.S. car registrations account for 20.4% of total world car registrations.
- U.S. truck and bus registrations account for 40.8% of total world car registrations.
- The average U.S. household vehicle travels 11,300 miles per year.

### Heavy Truck Characteristics

- 10,973,000 heavy trucks were registered in the U.S. in 2009.
- In 2002 (the last time a survey was conducted), heavy trucks accounted for 80% of medium and heavy truck fuel use.

**Note:** Data are for calendar year 2009 or 2010 unless otherwise noted.

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## TABLE OF CONTENTS

|   |              |
|---|--------------|
| <b>FOREWORD .....</b>   | <b>xix</b>   |
| <b>ACKNOWLEDGMENTS .....</b>  | <b>xxi</b>   |
| <b>ABSTRACT .....</b>   | <b>xxiii</b> |
| <b>INTRODUCTION.....</b>  | <b>xxv</b>   |
| <b>CHAPTER 1    PETROLEUM.....</b>  | <b>1–1</b>   |
| Table 1.1      World Fossil Fuel Potential .....  | 1–2          |
| Table 1.2      World Crude Oil Production, 1960–2010 .....  | 1–3          |
| Table 1.3      World Petroleum Production, 1973–2010 .....  | 1–4          |
| Table 1.4      World Petroleum Consumption, 1960–2010 .....   | 1–5          |
| <i>Figure 1.1      World Oil Reserves, Production and Consumption, 2009.....</i>                            | <i>1–6</i>   |
| Table 1.5      World Oil Reserves, Production and Consumption, 2009.....                                    | 1–6          |
| <i>Figure 1.2      World Natural Gas Reserves, Production and Consumption, 2009.....</i>                    | <i>1–7</i>   |
| Table 1.6      World Natural Gas Reserves, Production and Consumption, 2009.....                            | 1–7          |
| Table 1.7      U.S. Petroleum Imports by World Region of Origin, 1960–2010 .....                            | 1–8          |
| <i>Figure 1.3      Oil Price and Economic Growth, 1970–2010.....</i>  | <i>1–9</i>   |
| <i>Figure 1.4      Costs of Oil Dependence to the U.S. Economy, 1970–2010.....</i>                          | <i>1–10</i>  |
| <i>Figure 1.5      Refinery Gross Output by World Region, 2000 and 2010 .....</i>                           | <i>1–11</i>  |
| Table 1.8      U.S. Refinery Input of Crude Oil and Petroleum Products, 1987–2009.....                      | 1–12         |
| Table 1.9      Refinery Yield of Petroleum Products from a Barrel of Crude Oil,<br>1978–2010.....           | 1–13         |
| Table 1.10     United States Petroleum Production, Imports and Exports, 1950–2010 .....                     | 1–14         |
| Table 1.11     Petroleum Production and Consumption and Some Important Percent<br>Shares, 1950–2010 .....   | 1–15         |
| <i>Figure 1.6      United States Petroleum Production and Consumption – All Sectors,<br/>1973–2035.....</i> | <i>1–16</i>  |

|                   |   |             |
|-------------------|---|-------------|
| <i>Figure 1.7</i> | <i>United States Petroleum Production, Transportation and Consumption, 1970–2035.....</i> | <i>1–17</i> |
| Table 1.12        | Consumption of Petroleum by End-Use Sector, 1973–2010.....                                | 1–18        |
| Table 1.13        | Highway Transportation Petroleum Consumption by Mode, 1970–2009 .....                     | 1–19        |
| Table 1.14        | Nonhighway Transportation Petroleum Consumption by Mode, 1970–2009.....                   | 1–20        |
| Table 1.15        | Transportation Petroleum Use by Mode, 2008–2009 .....                                     | 1–21        |
| <b>CHAPTER 2</b>  | <b>ENERGY .....</b>   | <b>2–1</b>  |
| <i>Figure 2.1</i> | <i>World Consumption of Primary Energy, 2008 .....</i>                                    | <i>2–2</i>  |
| Table 2.1         | U. S. Consumption of Total Energy by End-Use Sector, 1973–2010 .....                      | 2–3         |
| Table 2.2         | Distribution of Energy Consumption by Source, 1973 and 2010.....                          | 2–4         |
| Table 2.3         | Alternative Fuel and Oxygenate Consumption, 2003–2009.....                                | 2–5         |
| Table 2.4         | Ethanol Consumption, 1995–2009.....   | 2–6         |
| Table 2.5         | Domestic Consumption of Transportation Energy by Mode and Fuel Type, 2009 .....           | 2–7         |
| Table 2.6         | Transportation Energy Use by Mode, 2008–2009.....   | 2–8         |
| Table 2.7         | Highway Transportation Energy Consumption by Mode, 1970–2009 .....                        | 2–9         |
| Table 2.8         | Nonhighway Transportation Energy Consumption by Mode, 1970–2009 .....                     | 2–10        |
| Table 2.9         | Off-highway Transportation-related Fuel Consumption from the NonRoad Model, 2009 .....    | 2–11        |
| Table 2.10        | Fuel Consumption from Lawn and Garden Equipment, 2009 .....                               | 2–12        |
| Table 2.11        | Highway Usage of Gasoline and Diesel, 1973–2009 .....                                     | 2–13        |
| Table 2.12        | Passenger Travel and Energy Use, 2009.....  | 2–14        |
| Table 2.13        | Energy Intensities of Highway Passenger Modes, 1970–2009.....                             | 2–15        |
| Table 2.14        | Energy Intensities of Nonhighway Passenger Modes, 1970–2009.....                          | 2–16        |
| <i>Figure 2.2</i> | <i>Energy Intensity of Light Rail Transit Systems, 2009.....</i>                          | <i>2–17</i> |



|                   |   |             |
|-------------------|---|-------------|
| <i>Figure 2.3</i> | <i>Energy Intensity of Heavy Rail Systems, 2009.....</i>  | <i>2–18</i> |
| <i>Figure 2.4</i> | <i>Energy Intensity of Commuter Rail Systems, 2009.....</i>   | <i>2–18</i> |
| Table 2.15        | Energy Intensities of Freight Modes, 1970–2009.....   | 2–19        |
| <b>CHAPTER 3</b>  | <b>ALL HIGHWAY VEHICLES AND CHARACTERISTICS .....</b>   | <b>3–1</b>  |
| Table 3.1         | Car Registrations for Selected Countries, 1960–2009.....  | 3–2         |
| Table 3.2         | Truck and Bus Registrations for Selected Countries, 1960–2009 .....                                       | 3–3         |
| Table 3.3         | U.S. Cars and Trucks in Use, 1970–2009 .....  | 3–5         |
| <i>Figure 3.1</i> | <i>Vehicles per Thousand People: U.S. (Over Time) Compared to Other Countries (in 1999 and 2009).....</i> | <i>3–6</i>  |
| Table 3.4         | Vehicles per Thousand People in Other Countries, 1999 and 2009 .....                                      | 3–8         |
| Table 3.5         | Vehicles per Thousand People in the United States, 1990–2009 .....  | 3–9         |
| Table 3.6         | Shares of Highway Vehicle-Miles Traveled by Vehicle Type, 1970–2009.....                                  | 3–10        |
| Table 3.7         | Cars in Operation and Vehicle Travel by Age, 1970 and 2001 .....  | 3–11        |
| Table 3.8         | Trucks in Operation and Vehicle Travel by Age, 1970 and 2001 .....  | 3–12        |
| Table 3.9         | U.S. Average Vehicle Age, 1995–2009 .....   | 3–13        |
| Table 3.10        | New Retail Vehicle Sales, 1970–2010.....  | 3–14        |
| Table 3.11        | Car Scrappage and Survival Rates, 1970, 1980 and 1990 Model Years .....                                   | 3–15        |
| Table 3.12        | Light Truck Scrappage and Survival Rates .....  | 3–16        |
| Table 3.13        | Heavy Truck Scrappage and Survival Rates.....   | 3–17        |
| Table 3.14        | Car and Light Truck Survivability Rates and Lifetime Miles .....  | 3–18        |
| <b>CHAPTER 4</b>  | <b>LIGHT VEHICLES AND CHARACTERISTICS .....</b>   | <b>4–1</b>  |
| Table 4.1         | Summary Statistics for Cars, 1970–2009.....   | 4–2         |
| Table 4.2         | Summary Statistics for Two-Axle, Four-Tire Trucks, 1970–2009.....   | 4–3         |
| Table 4.3         | Summary Statistics on Class 1, Class 2a, and Class 2b Light Trucks .....                                  | 4–4         |

|                   |   |             |
|-------------------|---|-------------|
| Table 4.4         | Sales Estimates of Class 1, Class 2a, and Class 2b Light Trucks, 1989–1999.....   | 4–4         |
| Table 4.5         | New Retail Car Sales in the United States, 1970–2010.....   | 4–5         |
| Table 4.6         | New Retail Sales of Trucks 10,000 Pounds GVW and Less in the United States, 1970–2010 .....   | 4–6         |
| Table 4.7         | Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Cars, Selected Model Years 1975–2010..... | 4–7         |
| Table 4.8         | Definition of Wagons in Model Year 2010 .....   | 4–8         |
| Table 4.9         | Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Light Trucks, Model Years 1975–2010.....  | 4–9         |
| Table 4.10        | Light Vehicle Market Shares by Size Class, Model Years 1975–2010 .....  | 4–10        |
| <i>Figure 4.1</i> | <i>Light Vehicle Market Shares, Model Years 1975–2010 .....</i>   | <i>4–11</i> |
| Table 4.11        | Sales-Weighted Engine Size of New Domestic and Import Cars by Size Class, Model Years 1975–2010 .....                               | 4–12        |
| Table 4.12        | Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class, Model Years 1975–2010 .....                       | 4–13        |
| Table 4.13        | Sales-Weighted Curb Weight of New Domestic and Import Cars by Size Class, Model Years 1975–2010 .....                               | 4–14        |
| Table 4.14        | Sales-Weighted Interior Space of New Domestic and Import Cars by Size Class, Model Years 1977–2010 .....                            | 4–15        |
| Table 4.15        | Average Material Consumption for a Light Vehicle, Model Years 1995, 2000, and 2009.....   | 4–16        |
| Table 4.16        | New Light Vehicle Dealerships and Sales, 1970–2009.....   | 4–17        |
| Table 4.17        | Conventional Refueling Stations, 1993–2009 .....  | 4–18        |
| Table 4.18        | Fuel Economy and Carbon Dioxide Emissions Standards, MY 2012–2016 .....   | 4–19        |
| Table 4.19        | Fuel Economy and Carbon Dioxide Targets for Model Year 2016.....  | 4–20        |
| Table 4.20        | Car Corporate Average Fuel Economy (CAFE) Standards versus Sales-Weighted Fuel Economy Estimates, 1978–2011 .....                   | 4–21        |
| Table 4.21        | Light Truck Corporate Average Fuel Economy (CAFE) Standards versus Sales-Weighted Fuel Economy Estimates, 1978–2011 .....           | 4–22        |

|                   |  |             |
|-------------------|--|-------------|
| Table 4.22        | Corporate Average Fuel Economy (CAFE) Fines Collected, 1983–2009.....              | 4–23        |
| Table 4.23        | The Gas Guzzler Tax on New Cars .....  | 4–24        |
| Table 4.24        | Tax Receipts from the Sale of Gas Guzzlers, 1980–2009 .....                        | 4–25        |
| Table 4.25        | Fuel Economy by Speed, PSAT Model Results .....                                    | 4–26        |
| Table 4.26        | Fuel Economy by Speed, 1973, 1984, and 1997 Studies.....                           | 4–27        |
| <i>Figure 4.2</i> | <i>Fuel Economy by Speed, 1973, 1984, and 1997 Studies .....</i>                   | <i>4–28</i> |
| Table 4.27        | Steady Speed Fuel Economy for Vehicles Tested in the 1997 Study.....               | 4–29        |
| Table 4.28        | Driving Cycle Attributes.....  | 4–30        |
| <i>Figure 4.3</i> | <i>City Driving Cycle .....</i>  | <i>4–31</i> |
| <i>Figure 4.4</i> | <i>Highway Driving Cycle.....</i>  | <i>4–31</i> |
| <i>Figure 4.5</i> | <i>Air Conditioning (SC03) Driving Cycle .....</i>                                 | <i>4–32</i> |
| <i>Figure 4.6</i> | <i>Cold Temperature (Cold FTP) Driving Cycle .....</i>                             | <i>4–32</i> |
| <i>Figure 4.7</i> | <i>High Speed (US06) Driving Cycle.....</i>  | <i>4–33</i> |
| <i>Figure 4.8</i> | <i>New York City Driving Cycle.....</i>  | <i>4–34</i> |
| <i>Figure 4.9</i> | <i>Representative Number Five Driving Cycle .....</i>                              | <i>4–34</i> |
| Table 4.29        | Projected Fuel Economies from U.S., European, and Japanese<br>Driving Cycles ..... | 4–35        |
| Table 4.30        | Comparison of U.S., European, and Japanese Driving Cycles .....                    | 4–36        |
| Table 4.31        | Summary Statistics on Demand Response Vehicles, 1994–2009.....                     | 4–37        |
| <b>CHAPTER 5</b>  | <b>HEAVY VEHICLES AND CHARACTERISTICS.....</b>                                     | <b>5–1</b>  |
| Table 5.1         | Summary Statistics for Heavy Single-Unit Trucks, 1970–2009.....                    | 5–2         |
| Table 5.2         | Summary Statistics for Combination Trucks, 1970–2009 .....                         | 5–3         |
| Table 5.3         | New Retail Truck Sales by Gross Vehicle Weight, 1970–2010.....                     | 5–4         |
| Table 5.4         | Truck Statistics by Gross Vehicle Weight Class, 2002 .....                         | 5–6         |

|                  |  |            |
|------------------|--|------------|
| Table 5.5        | Truck Harmonic Mean Fuel Economy by Size Class, 1992, 1997, and 2002.....  | 5–6        |
| Table 5.6        | Truck Statistics by Size, 2002.....  | 5–7        |
| Table 5.7        | Percentage of Trucks by Size Ranked by Major Use, 2002 .....   | 5–8        |
| Table 5.8        | Percentage of Trucks by Fleet Size and Primary Fueling Facility, 2002.....   | 5–9        |
| Table 5.9        | Share of Trucks by Major Use and Primary Fueling Facility, 2002.....   | 5–10       |
| Figure 5.1       | <i>Distribution of Trucks over 26,000 lbs. Less than Two Years Old by Vehicle-Miles Traveled .....</i>   | 5–11       |
| Figure 5.2       | <i>Share of Heavy Trucks with Selected Electronic Features, 2002 .....</i>   | 5–12       |
| Table 5.10       | Effect of Terrain on Class 8 Truck Fuel Economy .....  | 5–14       |
| Table 5.11       | Fuel Economy for Class 8 Trucks as Function of Speed and Tractor-Trailer Tire Combination .....  | 5–15       |
| Figure 5.3       | <i>Class 8 Truck Fuel Economy as a Function of Speed and Tractor-Trailer Tire Combination and Percentage of Total Distance Traveled as a Function of Speed .....</i> | 5–16       |
| Figure 5.4       | <i>Class 8 Truck Percent of Total Fuel Consumed as a Function of Speed and Tractor-Trailer Tire Combination .....</i>  | 5–17       |
| Table 5.12       | Class 8 Truck Weight by Component.....   | 5–18       |
| Table 5.13       | Gross Vehicle Weight vs. Empty Vehicle Weight.....   | 5–19       |
| Figure 5.5       | <i>Distribution of Five-Axle Tractor-Trailers by On-Road Vehicle Weight, 2008 .....</i>  | 5–20       |
| Table 5.14       | Growth of Freight in the United States: Comparison of the 1997, 2002 and 2007 Commodity Flow Surveys.....  | 5–22       |
| Table 5.15       | Growth of Freight Miles in the United States: Comparison of the 1997, 2002 and 2007 Commodity Flow Surveys .....   | 5–23       |
| Table 5.16       | Summary Statistics on Transit Buses and Trolleybuses, 1994–2009 .....  | 5–24       |
| <b>CHAPTER 6</b> | <b>ALTERNATIVE FUEL AND ADVANCED TECHNOLOGY VEHICLES AND CHARACTERISTICS .....</b>   | <b>6–1</b> |
| Table 6.1        | Estimates of Alternative Fuel Vehicles in Use, 1995–2009 .....   | 6–3        |

|  |  |            |
|--|--|------------|
| Table 6.2  | Alternative Fuel Transit Vehicles, 2009 .....  | 6–4        |
| Table 6.3  | Alternative Fuel Vehicles Available by Manufacturer, Model Year 2011 .....                     | 6–5        |
| Table 6.4  | Hybrid Electric Vehicles Available by Manufacturer, Model Year 2011 .....                      | 6–7        |
| Table 6.5  | Number of Alternative Refuel Sites by State and Fuel Type, 2011.....                           | 6–8        |
| <i>Figure 6.1</i>  | <i>Clean Cities Coalitions</i> .....   | 6–9        |
| Table 6.6  | Properties of Conventional and Alternative Fuels .....   | 6–11       |
| <b>CHAPTER 7 FLEET VEHICLES AND CHARACTERISTICS.....</b>     |  | <b>7–1</b> |
| <i>Figure 7.1</i>  | <i>Fleet Vehicles in Service as of January 1, 2010</i> .....                                   | 7–2        |
| Table 7.1  | New Light Fleet Vehicle Registrations by Vehicle Type, Model<br>Year 2009.....                 | 7–3        |
| Table 7.2  | Average Length of Time Business Fleet Vehicles are in Service, 2009.....                       | 7–3        |
| Table 7.3  | Average Annual Vehicle-Miles of Travel for Business Fleet Vehicles,<br>2009.....               | 7–3        |
| <i>Figure 7.2</i>  | <i>Average Miles per Domestic Federal Vehicle by Vehicle Type, 2010</i> .....                  | 7–4        |
| Table 7.4  | Federal Government Vehicles, 2001–2010.....  | 7–5        |
| Table 7.5  | Federal Fleet Vehicle Acquisitions by Fuel Type, FY 2002– 2010 .....                           | 7–6        |
| Table 7.6  | Fuel Consumed by Federal Government Fleets, FY 2000–2010.....                                  | 7–6        |
| Table 7.7  | Federal Government Vehicles by Agency, FY 2010 .....   | 7–7        |
| <b>CHAPTER 8 HOUSEHOLD VEHICLES AND CHARACTERISTICS.....</b> |  | <b>8–1</b> |
| Table 8.1  | Population and Vehicle Profile, 1950–2009 .....  | 8–2        |
| Table 8.2  | Vehicles and Vehicle-Miles per Capita, 1950–2009 .....   | 8–3        |
| Table 8.3  | Average Annual Expenditures of Households by Income, 2009.....                                 | 8–4        |
| Table 8.4  | Household Vehicle Ownership, 1960–2009 Census.....   | 8–5        |
| Table 8.5  | Demographic Statistics from the 1969, 1977, 1983, 1990, 1995 NPTS<br>and 2001, 2009 NHTS ..... | 8–6        |

|                   |   |             |
|-------------------|---|-------------|
| Table 8.6         | Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per Household 1969, 1977, 1983, 1990, 1995 NPTS and 2001, 2009 NHTS ..... | 8–7         |
| Table 8.7         | Average Number of Vehicles and Vehicle Travel per Household, 1990 NPTS and 2001 and 2009 NHTS.....                                    | 8–8         |
| Table 8.8         | Trip Statistics by Trip Purpose, 2001 and 2009 NHTS .....   | 8–9         |
| <i>Figure 8.1</i> | <i>Average Vehicle Occupancy by Vehicle Type, 1995 NPTS and 2009 NHTS.....</i>  | <i>8–10</i> |
| <i>Figure 8.2</i> | <i>Average Vehicle Occupancy by Trip Purpose, 1977 NPTS and 2009 NHTS.....</i>  | <i>8–11</i> |
| Table 8.9         | Average Annual Miles per Household Vehicle by Vehicle Age .....   | 8–12        |
| Table 8.10        | Self-Reported vs. Odometer Average Annual Miles, 1995 NPTS and 2001 NHTS .....  | 8–13        |
| <i>Figure 8.3</i> | <i>Share of Vehicle Trips by Trip Distance, 2009 NHTS.....</i>  | <i>8–14</i> |
| <i>Figure 8.4</i> | <i>Share of Vehicle Trips to Work by Trip Distance, 2009 NHTS.....</i>  | <i>8–14</i> |
| Table 8.11        | Share of Vehicles by Annual Miles of Travel and Vehicle Age, 2009 NHTS .....  | 8–15        |
| Table 8.12        | Household Vehicle Trips, 2009 NHTS .....  | 8–16        |
| <i>Figure 8.5</i> | <i>Average Daily Miles Driven (per Driver), 2009 NHTS.....</i>  | <i>8–16</i> |
| Table 8.13        | Daily Vehicle Miles of Travel (per Vehicle) by Number of Vehicles in the Household, 2009 NHTS.....                                    | 8–17        |
| Table 8.14        | Daily and Annual Vehicle Miles of Travel and Average Age for Each Vehicle in a Household, 2009 NHTS .....                             | 8–17        |
| <i>Figure 8.6</i> | <i>Daily Vehicle Miles of Travel for Each Vehicle in a Household, 2009 NHTS.....</i>  | <i>8–18</i> |
| <i>Figure 8.7</i> | <i>Annual Vehicle Miles of Travel for Each Vehicle in a Household, 2009 NHTS.....</i>   | <i>8–18</i> |
| Table 8.15        | Means of Transportation to Work, 1980, 1990, 2000 and 2009 .....  | 8–19        |
| Table 8.16        | Characteristics of U.S. Daily per Vehicle Driving vs. Dwelling Unit Type and Density .....  | 8–20        |
| Table 8.17        | Housing Unit Characteristics, 2009 .....  | 8–20        |

|                    |  |             |
|--------------------|--|-------------|
| Table 8.18         | Workers by Commute Time, 1990, 2000, and 2009.....   | 8–21        |
| Table 8.19         | Bicycle Sales, 1981-2009.....  | 8–22        |
| <i>Figure 8.8</i>  | <i>Walk and Bike Trips by Trip Purpose, 2009 NHTS.....</i>   | <i>8–23</i> |
| Table 8.20         | Long-Distance Trip Characteristics, 2001 NHTS.....   | 8–25        |
| <b>CHAPTER 9</b>   | <b>NONHIGHWAY MODES .....</b>  | <b>9–1</b>  |
| Table 9.1          | Nonhighway Energy Use Shares, 1970–2009 .....  | 9–2         |
| Table 9.2          | Summary Statistics for U.S. Domestic and International Certificated<br>Route Air Carriers (Combined Totals), 1970–2009 ..... | 9–3         |
| Table 9.3          | Summary Statistics for General Aviation, 1970–2009 .....   | 9–4         |
| Table 9.4          | Tonnage Statistics for Domestic and International Waterborne<br>Commerce, 1970–2009 .....                                    | 9–5         |
| Table 9.5          | Summary Statistics for Domestic Waterborne Commerce, 1970–2009 .....   | 9–6         |
| Table 9.6          | Recreational Boat Energy Use, 1970–2009 .....  | 9–7         |
| Table 9.7          | Class I Railroad Freight Systems in the United States Ranked by<br>Revenue Ton–Miles, 2009 .....                             | 9–8         |
| Table 9.8          | Summary Statistics for Class I Freight Railroads, 1970–2009 .....  | 9–9         |
| Table 9.9          | Intermodal Rail Traffic, 1965–2009 .....   | 9–10        |
| Table 9.10         | Summary Statistics for the National Railroad Passenger Corporation<br>(Amtrak), 1971–2009.....                               | 9–11        |
| Table 9.11         | Summary Statistics for Commuter Rail Operations, 1984–2009.....  | 9–12        |
| Table 9.12         | Summary Statistics for Rail Transit Operations, 1970–2009 .....  | 9–13        |
| <b>CHAPTER 10</b>  | <b>TRANSPORTATION AND THE ECONOMY .....</b>  | <b>10–1</b> |
| <i>Figure 10.1</i> | <i>Transportation Services Index, January 1990–January 2011 .....</i>  | <i>10–2</i> |
| Table 10.1         | Gasoline Prices for Selected Countries, 1990–2010.....   | 10–3        |
| Table 10.2         | Diesel Fuel Prices for Selected Countries, 1998–2010.....  | 10–4        |
| <i>Figure 10.2</i> | <i>Gasoline Prices for Selected Countries, 1990 and 2010 .....</i>   | <i>10–5</i> |

|                    |   |             |
|--------------------|---|-------------|
| <i>Figure 10.3</i> | <i>Diesel Prices for Selected Countries, 1990 and 2010</i> .....                            | 10–6        |
| Table 10.3         | Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978–2010 .....                  | 10–7        |
| Table 10.4         | Retail Prices for Motor Fuel, 1978–2010 .....   | 10–8        |
| Table 10.5         | Refiner Sales Prices for Propane and No. 2 Diesel, 1978–2010.....                           | 10–9        |
| Table 10.6         | Refiner Sales Prices for Aviation Gasoline and Jet Fuel, 1978–2010 .....                    | 10–10       |
| Table 10.7         | State Tax Exemptions for Gasohol, 2009 .....  | 10–11       |
| Table 10.8         | Federal Excise Taxes on Motor Fuels, 2009.....  | 10–11       |
| Table 10.9         | Federal and State Alternative Fuel Incentives, 2011 .....                                   | 10–12       |
| Table 10.10        | Federal and State Advanced Technology Incentives, 2011 .....                                | 10–13       |
| Table 10.11        | Average Price of a New Car, 1906–2009 .....   | 10–14       |
| Table 10.12        | Average Price of a New Car (Domestic and Import), 1970–2009.....                            | 10–15       |
| Table 10.13        | Car Operating Cost per Mile, 1985–2010.....   | 10–16       |
| Table 10.14        | Fixed Car Operating Costs per Year, 1975–2010.....  | 10–17       |
| Table 10.15        | Personal Consumption Expenditures, 1970–2010 .....  | 10–18       |
| Table 10.16        | Consumer Price Indices, 1970–2010 .....   | 10–18       |
| Table 10.17        | Transportation-related Employment, 2000 and 2010 .....                                      | 10–19       |
| Table 10.18        | U.S. Employment for Motor Vehicles and Motor Vehicle Parts<br>Manufacturing, 1990–2010..... | 10–20       |
| <b>CHAPTER 11</b>  | <b>GREENHOUSE GAS EMISSIONS</b> .....   | <b>11–1</b> |
| Table 11.1         | World Carbon Dioxide Emissions, 1990 and 2007 .....   | 11–2        |
| Table 11.2         | Numerical Estimates of Global Warming Potentials Compared<br>with Carbon Dioxide.....       | 11–3        |
| Table 11.3         | U.S. Emissions of Greenhouse Gases, based on Global Warming<br>Potential, 1990–2009 .....   | 11–4        |
| Table 11.4         | Total U.S. Greenhouse Emissions by End-Use Sector, 2009 .....                               | 11–5        |



|   |   |             |
|---|---|-------------|
| Table 11.5                                      | U.S. Carbon Emissions from Fossil Energy Consumption by End-Use Sector, 1990–2009 .....                                   | 11–6        |
| Table 11.6                                      | U.S. Carbon Emissions from Energy Use in the Transportation Sector, 1990–2009 .....                                       | 11–7        |
| Table 11.7                                      | Transportation Greenhouse Gas Emissions by Mode, 1990 and 2009 .....  | 11–8        |
| Figure 11.1                                     | <i>REET Model</i> .....   | 11–9        |
| Figure 11.2                                     | <i>REET Model Feedstocks and Fuels</i> .....  | 11–10       |
| Figure 11.3                                     | <i>Well-to-Wheel Emissions for Various Fuels and Vehicle Technologies</i> .....   | 11–11       |
| Table 11.8                                      | Sales-Weighted Annual Carbon Footprint of New Domestic and Import Cars by Size Class, Model Years 1975-2010.....          | 11–13       |
| Table 11.9                                      | Sales-Weighted Annual Carbon Footprint of New Domestic and Import Light Trucks by Size Class, Model Years 1975-2010 ..... | 11–14       |
| Table 11.10                                     | Average Annual Carbon Footprint by Vehicle Classification, 1975 and 2010.....   | 11–15       |
| Table 11.11                                     | Carbon Dioxide Emissions from a Gallon of Fuel.....   | 11–16       |
| <b>CHAPTER 12 CRITERIA AIR POLLUTANTS .....</b> |   | <b>12–1</b> |
| Table 12.1                                      | Total National Emissions of the Criteria Air Pollutants by Sector, 2008 .....   | 12–2        |
| Table 12.2                                      | Total National Emissions of Carbon Monoxide, 1970–2008 .....  | 12–3        |
| Table 12.3                                      | Emissions of Carbon Monoxide from Highway Vehicles, 1970–2005 .....   | 12–4        |
| Table 12.4                                      | Total National Emissions of Nitrogen Oxides, 1970–2008 .....  | 12–5        |
| Table 12.5                                      | Emissions of Nitrogen Oxides from Highway Vehicles, 1970–2005 .....   | 12–6        |
| Table 12.6                                      | Total National Emissions of Volatile Organic Compounds, 1970–2008 .....   | 12–7        |
| Table 12.7                                      | Emissions of Volatile Organic Compounds from Highway Vehicles, 1970–2005.....   | 12–8        |
| Table 12.8                                      | Total National Emissions of Particulate Matter (PM–10), 1970–2008 .....   | 12–9        |
| Table 12.9                                      | Emissions of Particulate Matter (PM–10) from Highway Vehicles, 1970–2005.....   | 12–10       |
| Table 12.10                                     | Total National Emissions of Particulate Matter (PM-2.5), 1990–2008 .....  | 12–11       |

|  |   |            |
|--|---|------------|
| Table 12.11  | Emissions of Particulate Matter (PM-2.5) from Highway Vehicles, 1990–2005.....  | 12–12      |
| Table 12.12  | Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger Vehicle – Tier 2 Exhaust Emission Standards.....      | 12–14      |
| Table 12.13  | Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger Vehicle – Tier 2 Evaporative Emission Standards ..... | 12–15      |
| Table 12.14  | Heavy-Duty Highway Compression-Ignition Engines and Urban Buses – Exhaust Emission Standards .....                    | 12–16      |
| Table 12.15  | Heavy-Duty Highway Spark-Ignition Engines – Exhaust Emission Standards.....   | 12–18      |
| Table 12.16  | Heavy-Duty Highway Compression Ignition and Spark-Ignition Engines – Evaporative Emission Standards.....              | 12–20      |
| Table 12.17  | California Car, Light Truck and Medium Truck Emission Certification Standards.....                                    | 12–21      |
| Table 12.18  | Aircraft – Exhaust Emission Standards .....   | 12–22      |
| Table 12.19  | Nonroad Compression-Ignition Engines – Exhaust Emission Standards .....   | 12–23      |
| Table 12.20  | Nonroad Large Spark-Ignition Engines – Exhaust and Evaporative Emission Standards.....                                | 12–25      |
| Table 12.21  | Locomotives – Exhaust Emission Standards .....  | 12–26      |
| Table 12.22  | Marine Compression-Ignition (CI) Engines – Exhaust Emission Standards.....  | 12–28      |
| Table 12.23  | Marine Spark-Ignition Engines and Vessels – Exhaust Emission Standards.....   | 12–32      |
| Table 12.24  | Nonroad Recreational Engines and Vehicles – Exhaust Emission Standards.....   | 12–34      |
| Table 12.25  | Gasoline Sulfur Standards.....  | 12–36      |
| Table 12.26  | Highway, Nonroad, Locomotive, and Marine (NRLM) Diesel Fuel Sulfur Standards.....                                     | 12–37      |
| <b>APPENDIX A. SOURCES &amp; METHODOLOGIES .....</b> |   | <b>A–1</b> |
| <b>APPENDIX B. CONVERSIONS.....</b>                  |   | <b>B–1</b> |
| <b>APPENDIX C. MAPS.....</b>                         |   | <b>C–1</b> |

**GLOSSARY..... G-1**

**INDEX..... I-1**



## FOREWORD

Welcome to this 30th edition of the Transportation Energy Data Book. Twenty-two of these editions have been produced by Stacy Davis. I and the Vehicle Technologies Program are grateful for the dedication, consistency, and the skill she has brought to this effort.

I would like to bring to your attention some of the data that are new in this edition:

**Table 3.13. Heavy Truck Scrappage and Survival Rates --** Data for heavy trucks, which had been in previous editions, is added back into the report.

**Table 6.2. Alternative Fuel Transit Vehicles, 2009 --** For eight modes, the average vehicle age, the percent powered by alternative fuels, and the number of vehicles are provided.

Fifteen new emission standards tables have been added to Chapter 12. They include the following:

Table 12.12. Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger Vehicle – Tier 2 Evaporative Exhaust Standards

Table 12.13. Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger Vehicle – Tier 2 Evaporative Emission Standards

Table 12.14. Heavy-Duty Highway Compression-Ignition Engines and Urban Buses – Exhaust Emission Standards

Table 12.15. Heavy-Duty Highway Spark-Ignition Engines– Exhaust Emission Standards

Table 12.16. Heavy-Duty Highway Compression-Ignition and Spark-Ignition Engines Evaporative Emission Standards

Table 12.17. California Car, Light Truck, and Medium Truck Emission Certification Standards

Table 12.18. Aircraft – Exhaust Emissions Standards

Table 12.19. Nonroad Compression-Ignition Engine – Exhaust Emission Standards

Table 12.20. Nonroad Large Spark-Ignition Engines – Exhaust and Evaporative Emission Standards

Table 12.21. Locomotive – Exhaust Emissions Standards

Table 12.22. Marine Compression-Ignition (CI) Engines – Exhaust Emission Standards

Table 12.23. Marine Spark-Ignition Engines and Vessels – Exhaust Emission Standards

Table 12.24. Nonroad Recreational Engines and Vehicles – Exhaust Emission Standards

Table 12.25. Gasoline Sulfur Standards

Table 12.26. Highway, Nonroad, Locomotive, and Marine (NRLM) Diesel Fuel Sulfur Stan

I hope you find value in this data book. Stacy and I welcome suggestions on how to improve it.





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The authors would like to express their gratitude to the many individuals who assisted in the preparation of this document. First, we would like to thank Phil Patterson, Jacob Ward, and the Vehicle Technologies Program staff for their continued support of the Transportation Energy Data Book project. We would also like to thank Lindsey Marlar for the cover. Finally, this book would not have been possible without the dedication of Debbie Bain, who masterfully prepared the manuscript.





## ABSTRACT

The *Transportation Energy Data Book: Edition 30* is a statistical compendium prepared and published by Oak Ridge National Laboratory (ORNL) under contract with the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Vehicle Technologies Program. Designed for use as a desk-top reference, the Data Book represents an assembly and display of statistics and information that characterize transportation activity, and presents data on other factors that influence transportation energy use. The purpose of this document is to present relevant statistical data in the form of tables and graphs. The latest edition of the Data Book is available to a larger audience via the Internet ([cta.ornl.gov/data](http://cta.ornl.gov/data)).

This edition of the Data Book has 12 chapters which focus on various aspects of the transportation industry. Chapter 1 focuses on petroleum; Chapter 2 – energy; Chapter 3 – highway vehicles; Chapter 4 – light vehicles; Chapter 5 – heavy vehicles; Chapter 6 – alternative fuel vehicles; Chapter 7 – fleet vehicles; Chapter 8 – household vehicles; Chapter 9 – nonhighway modes; Chapter 10 – transportation and the economy; Chapter 11 – greenhouse gas emissions; and Chapter 12 – criteria pollutant emissions. The sources used represent the latest available data. There are also three appendices which include detailed source information for some tables, measures of conversion, and the definition of Census divisions and regions. A glossary of terms and a title index are also included for the reader's convenience.



## INTRODUCTION

In January 1976, the Transportation Energy Conservation (TEC) Division of the Energy Research and Development Administration contracted with Oak Ridge National Laboratory (ORNL) to prepare a Transportation Energy Conservation Data Book to be used by TEC staff in their evaluation of current and proposed conservation strategies. The major purposes of the Data Book were to draw together, under one cover, transportation data from diverse sources, to resolve data conflicts and inconsistencies, and to produce a comprehensive document. The first edition of the TEC Data Book was published in October 1976. With the passage of the Department of Energy (DOE) Organization Act, the work being conducted by the former Transportation Energy Conservation Division fell under the purview of the DOE's Office of Transportation Programs.

Policymakers and analysts need to be well-informed about activity in the transportation sector. The organization and scope of the data book reflect the need for different kinds of information. For this reason, Edition 30 updates much of the same type of data that is found in previous editions.

In any attempt to compile a comprehensive set of statistics on transportation activity, numerous instances of inadequacies and inaccuracies in the basic data are encountered. Where such problems occur, estimates are developed by ORNL. To minimize the misuse of these statistics, an appendix (Appendix A) is included to document the estimation procedures. The attempt is to provide sufficient information for the conscientious user to evaluate the estimates and to form their own opinions as to their utility. Clearly, the accuracy of the estimates cannot exceed the accuracy of the primary data, an accuracy which in most instances is unknown. In cases where data accuracy is known or substantial errors are strongly suspected in the data, the reader is alerted. In all cases it should be recognized that the estimates are not precise.

The majority of the statistics contained in the data book are taken directly from published sources, although these data may be reformatted for presentation by ORNL. Consequently, neither ORNL nor DOE endorses the validity of these data.



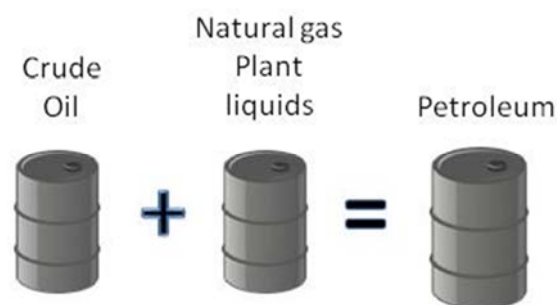
# Chapter 1

## Petroleum

### Summary Statistics from Tables/Figures in this Chapter

| Source     |   |                           |
|------------|---|---------------------------|
| Table 1.3  | World Petroleum Production, 2010 (million barrels per day) <sup>a</sup>           | 82.43                     |
|            | <i>U.S. Production (million barrels per day)</i>                                  | 7.51                      |
|            | <i>U.S. Share</i>   | 9.1%                      |
| Table 1.4  | World Petroleum Consumption, 2010 (million barrels per day)                       | 85.26                     |
|            | <i>U.S. Consumption (million barrels per day)</i>                                 | 19.15                     |
|            | <i>U.S. Share</i>   | 22.5%                     |
| Figure 1.5 | Average Refinery Yield, 2010  | OECD Europe North America |
|            | <i>Gasoline</i>   | 19.3% 42.7%               |
|            | <i>Diesel oil</i>   | 39.8% 25.3%               |
|            | <i>Residual fuel</i>  | 13.0% 5.8%                |
|            | <i>Kerosene</i>   | 6.8% 7.3%                 |
|            | <i>Other</i>  | 21.1% 18.9%               |
| Table 1.11 | U.S. transportation petroleum use as a percent of U.S. petroleum production, 2010 | 172.5%                    |
| Table 1.11 | Net imports as a percentage of U.S. petroleum consumption, 2010                   | 49.3%                     |
| Table 1.12 | Transportation share of U.S. petroleum consumption, 2010                          | 69.7%                     |
| Table 1.15 | Highway share of transportation petroleum consumption, 2009                       | 86.4%                     |
| Table 1.15 | Light vehicle share of transportation petroleum consumption, 2009                 | 64.3%                     |

In this document, petroleum is defined as crude oil (including lease condensate) and natural gas plant liquids.



<sup>a</sup> Because other liquids and processing gain are not included, the world production is smaller than world petroleum consumption.



*Although the world has consumed about 40% of estimated conventional oil resources, the total fossil fuel potential is huge. Methane hydrates—a potential source of natural gas—are included in the “additional occurrences” of unconventional natural gas, and constitute the largest resource.*

**Table 1.1**  
**World Fossil Fuel Potential**  
**(gigatonnes of carbon)**

|                | Consumption<br>(1860-1998) | Reserves | Resources | Additional<br>occurrences |
|----------------|----------------------------|----------|-----------|---------------------------|
| Oil            |                            |          |           |                           |
| Conventional   | 97                         | 120      | 121       | 0                         |
| Unconventional | 6                          | 102      | 305       | 914                       |
| Natural Gas    |                            |          |           |                           |
| Conventional   | 36                         | 83       | 170       | 0                         |
| Unconventional | 1                          | 144      | 364       | 14,176                    |
| Coal           | 155                        | 533      | 4,618     | <sup>a</sup>              |

**Source:**

Rogner, H.H., *World Energy Assessment: Energy and the Challenge of Sustainability, Part II*, Chapter 5, 2000, p. 149.

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<sup>a</sup> Data are not available.



*In 2010, the Organization of Petroleum Exporting Countries (OPEC) accounted for more than 40% of world oil production. Responding to low oil prices in early 2000, Mexico, Norway, Russia, and Oman joined OPEC in cutting production. This group of oil countries, referred to here as OPEC+, account for over 60% of world oil production.*

**Table 1.2**  
**World Crude Oil Production, 1960–2010<sup>a</sup>**  
**(million barrels per day)**

| Year                                    | United States | U.S. share | Total OPEC <sup>b</sup> | OPEC share | OPEC + <sup>c</sup> | OPEC + <sup>c</sup> share | Total non-OPEC | Persian Gulf nations <sup>d</sup> | Persian Gulf <sup>d</sup> share | World |
|---|---------------|------------|-------------------------|------------|---------------------|---------------------------|----------------|-----------------------------------|---------------------------------|-------|
| 1960                                    | 7.04          | 33.5%      | 8.70                    | 41.4%      | 12.25               | 58.3%                     | 12.29          | 5.27                              | 25.1%                           | 20.99 |
| 1965                                    | 7.80          | 25.7%      | 14.35                   | 47.3%      | 19.83               | 65.4%                     | 15.98          | 8.37                              | 27.6%                           | 30.33 |
| 1970                                    | 9.64          | 21.0%      | 23.30                   | 50.8%      | 31.12               | 67.8%                     | 22.59          | 13.39                             | 29.2%                           | 45.89 |
| 1975                                    | 8.38          | 15.9%      | 26.79                   | 50.3%      | 37.55               | 71.1%                     | 27.04          | 18.93                             | 35.8%                           | 52.83 |
| 1980                                    | 8.60          | 14.4%      | 26.38                   | 44.3%      | 40.80               | 68.5%                     | 34.18          | 17.96                             | 30.2%                           | 59.56 |
| 1985                                    | 8.97          | 16.6%      | 15.37                   | 28.5%      | 30.98               | 57.4%                     | 38.60          | 9.63                              | 17.8%                           | 53.97 |
| 1986                                    | 8.68          | 15.4%      | 18.28                   | 32.5%      | 34.05               | 60.6%                     | 37.95          | 11.70                             | 20.8%                           | 56.23 |
| 1987                                    | 8.35          | 14.7%      | 18.52                   | 32.7%      | 34.72               | 61.3%                     | 38.15          | 12.10                             | 21.4%                           | 56.67 |
| 1988                                    | 8.14          | 13.9%      | 20.32                   | 34.6%      | 36.66               | 62.4%                     | 38.42          | 13.46                             | 22.9%                           | 58.74 |
| 1989                                    | 7.61          | 12.7%      | 22.07                   | 36.9%      | 38.50               | 64.3%                     | 37.79          | 14.84                             | 24.8%                           | 59.86 |
| 1990                                    | 7.36          | 12.2%      | 22.49                   | 37.2%      | 38.34               | 63.4%                     | 38.00          | 15.28                             | 25.3%                           | 60.49 |
| 1991                                    | 7.42          | 12.3%      | 23.27                   | 38.6%      | 38.53               | 64.0%                     | 36.94          | 14.74                             | 24.5%                           | 60.21 |
| 1992                                    | 7.17          | 11.9%      | 24.40                   | 40.5%      | 37.67               | 62.6%                     | 35.81          | 15.97                             | 26.5%                           | 60.21 |
| 1993                                    | 6.85          | 11.4%      | 25.12                   | 41.7%      | 37.65               | 62.5%                     | 35.12          | 16.71                             | 27.7%                           | 60.24 |
| 1994                                    | 6.66          | 10.9%      | 25.51                   | 41.8%      | 37.67               | 61.8%                     | 35.48          | 16.96                             | 27.8%                           | 60.99 |
| 1995                                    | 6.56          | 10.5%      | 25.54                   | 40.9%      | 37.77               | 60.5%                     | 36.85          | 17.21                             | 27.6%                           | 62.39 |
| 1996                                    | 6.47          | 10.1%      | 26.02                   | 40.8%      | 38.70               | 60.7%                     | 37.73          | 17.37                             | 27.2%                           | 63.75 |
| 1997                                    | 6.45          | 9.8%       | 27.29                   | 41.5%      | 40.28               | 61.3%                     | 38.45          | 18.10                             | 27.5%                           | 65.74 |
| 1998                                    | 6.25          | 9.3%       | 28.37                   | 42.4%      | 41.21               | 61.5%                     | 38.70          | 19.34                             | 28.9%                           | 66.97 |
| 1999                                    | 5.88          | 8.9%       | 27.22                   | 41.3%      | 40.14               | 60.9%                     | 38.70          | 18.67                             | 28.3%                           | 65.92 |
| 2000                                    | 5.82          | 8.5%       | 28.98                   | 42.3%      | 42.66               | 62.3%                     | 39.52          | 19.89                             | 29.0%                           | 68.49 |
| 2001                                    | 5.80          | 8.5%       | 28.16                   | 41.4%      | 42.35               | 62.2%                     | 39.94          | 19.10                             | 28.0%                           | 68.10 |
| 2002                                    | 5.75          | 8.6%       | 26.39                   | 39.3%      | 41.01               | 61.1%                     | 40.77          | 17.79                             | 26.5%                           | 67.16 |
| 2003                                    | 5.68          | 8.2%       | 27.98                   | 40.3%      | 43.34               | 62.4%                     | 41.45          | 19.06                             | 27.5%                           | 69.43 |
| 2004                                    | 5.42          | 7.5%       | 30.41                   | 42.0%      | 46.30               | 63.9%                     | 42.06          | 20.79                             | 28.7%                           | 72.47 |
| 2005                                    | 5.18          | 7.0%       | 31.87                   | 43.2%      | 47.72               | 64.7%                     | 41.84          | 21.50                             | 29.2%                           | 73.71 |
| 2006                                    | 5.10          | 6.9%       | 31.59                   | 43.0%      | 47.32               | 64.4%                     | 41.84          | 21.23                             | 28.9%                           | 73.43 |
| 2007                                    | 5.06          | 6.9%       | 31.21                   | 42.8%      | 46.70               | 64.0%                     | 41.78          | 20.67                             | 28.3%                           | 72.98 |
| 2008                                    | 4.96          | 6.7%       | 32.48                   | 44.1%      | 47.57               | 64.6%                     | 41.17          | 21.91                             | 29.7%                           | 73.66 |
| 2009                                    | 5.36          | 7.4%       | 30.60                   | 42.3%      | 45.58               | 63.1%                     | 41.67          | 20.40                             | 28.2%                           | 72.26 |
| 2010                                    | 5.51          | 7.5%       | 31.26                   | 42.4%      | 46.25               | 62.8%                     | 42.42          | 20.91                             | 28.4%                           | 73.68 |
| <i>Average annual percentage change</i> |               |            |                         |            |                     |                           |                |                                   |                                 |       |
| 1960–2010                               | -0.5%         |            | 2.6%                    |            | 2.7%                |                           | 2.7%           | 2.8%                              |                                 | 2.5%  |
| 1970–2010                               | -1.4%         |            | 0.7%                    |            | 1.0%                |                           | 1.8%           | 1.1%                              |                                 | 1.2%  |
| 2000–2010                               | -0.5%         |            | 0.8%                    |            | 0.8%                |                           | 0.7%           | 0.5%                              |                                 | 0.7%  |

**Source:**

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2011, Washington, DC, 2011, Table 11.1a and 11.1b. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

<sup>a</sup> Includes lease condensate. Excludes natural gas plant liquids.

<sup>b</sup> See Glossary for membership.

<sup>c</sup> OPEC+ includes all OPEC nations plus Russia, Mexico, Norway and Oman.

<sup>d</sup> See Glossary for Persian Gulf Nations.



*This table shows petroleum production, which includes both crude oil and natural gas plant liquids. Because other liquids and processing gain are not included, the world total is smaller than world petroleum consumption (Table 1.4). The United States was responsible for 9.1% of the world's petroleum production in 2010 and 7.5% of the world's crude oil production (Table 1.2).*

**Table 1.3**  
**World Petroleum Production, 1973–2010<sup>a</sup>**  
**(million barrels per day)**

| Year                                    | United States | U.S. share | Total OPEC <sup>b</sup> | OPEC share | Total non-OPEC | Non-OPEC share | Persian Gulf nations <sup>c</sup> | Persian Gulf <sup>c</sup> share | World |
|---|---------------|------------|-------------------------|------------|----------------|----------------|-----------------------------------|---------------------------------|-------|
| 1973                                    | 10.95         | 18.7%      | 29.99                   | 51.3%      | 28.48          | 48.7%          | 20.86                             | 35.7%                           | 58.47 |
| 1974                                    | 10.44         | 17.8%      | 29.67                   | 50.7%      | 28.84          | 49.3%          | 21.51                             | 36.8%                           | 58.51 |
| 1975                                    | 10.01         | 18.0%      | 26.16                   | 47.0%      | 28.48          | 51.2%          | 19.18                             | 34.5%                           | 55.62 |
| 1976                                    | 9.74          | 16.2%      | 29.55                   | 49.1%      | 30.66          | 50.9%          | 21.81                             | 36.2%                           | 60.21 |
| 1977                                    | 9.86          | 15.7%      | 30.06                   | 47.9%      | 32.64          | 52.1%          | 22.06                             | 35.2%                           | 62.69 |
| 1978                                    | 10.27         | 16.2%      | 28.70                   | 45.4%      | 34.54          | 54.6%          | 21.02                             | 33.2%                           | 63.24 |
| 1979                                    | 10.14         | 15.4%      | 29.95                   | 45.4%      | 36.01          | 54.6%          | 21.52                             | 32.6%                           | 65.96 |
| 1980                                    | 10.17         | 16.1%      | 26.05                   | 41.3%      | 35.77          | 56.8%          | 18.50                             | 29.3%                           | 63.03 |
| 1981                                    | 10.18         | 17.1%      | 21.95                   | 36.8%      | 37.73          | 63.2%          | 15.84                             | 26.5%                           | 59.68 |
| 1982                                    | 10.20         | 17.9%      | 18.54                   | 32.5%      | 38.55          | 67.5%          | 12.77                             | 22.4%                           | 57.09 |
| 1983                                    | 10.25         | 18.0%      | 17.26                   | 30.3%      | 39.65          | 69.7%          | 11.63                             | 20.4%                           | 56.90 |
| 1984                                    | 10.51         | 18.0%      | 17.29                   | 29.6%      | 41.09          | 70.4%          | 11.39                             | 19.5%                           | 58.38 |
| 1985                                    | 10.58         | 18.3%      | 16.22                   | 28.0%      | 40.90          | 70.6%          | 10.28                             | 17.7%                           | 57.91 |
| 1986                                    | 10.23         | 16.9%      | 18.40                   | 30.5%      | 41.17          | 68.2%          | 12.40                             | 20.5%                           | 60.36 |
| 1987                                    | 9.94          | 16.3%      | 18.69                   | 30.7%      | 41.47          | 68.1%          | 12.82                             | 21.0%                           | 60.92 |
| 1988                                    | 9.77          | 15.5%      | 20.79                   | 32.9%      | 41.86          | 66.3%          | 14.27                             | 22.6%                           | 63.18 |
| 1989                                    | 9.16          | 14.2%      | 22.51                   | 35.0%      | 41.19          | 64.0%          | 15.69                             | 24.4%                           | 64.30 |
| 1990                                    | 8.91          | 13.7%      | 23.70                   | 36.4%      | 40.80          | 62.6%          | 16.21                             | 24.9%                           | 65.13 |
| 1991                                    | 9.08          | 14.0%      | 23.71                   | 36.5%      | 40.53          | 62.4%          | 15.67                             | 24.1%                           | 65.01 |
| 1992                                    | 8.87          | 13.7%      | 25.03                   | 38.5%      | 39.37          | 60.6%          | 16.97                             | 26.1%                           | 64.96 |
| 1993                                    | 8.58          | 13.2%      | 25.82                   | 39.6%      | 38.82          | 59.5%          | 17.76                             | 27.2%                           | 65.23 |
| 1994                                    | 8.39          | 12.6%      | 26.54                   | 39.9%      | 39.30          | 59.0%          | 18.29                             | 27.5%                           | 66.57 |
| 1995                                    | 8.32          | 12.2%      | 27.23                   | 40.0%      | 40.29          | 59.2%          | 18.57                             | 27.3%                           | 68.04 |
| 1996                                    | 8.30          | 11.9%      | 27.71                   | 39.9%      | 41.33          | 59.4%          | 18.72                             | 26.9%                           | 69.53 |
| 1997                                    | 8.27          | 11.5%      | 29.07                   | 40.6%      | 42.12          | 58.8%          | 19.52                             | 27.2%                           | 71.66 |
| 1998                                    | 8.01          | 11.0%      | 30.21                   | 41.4%      | 42.41          | 58.1%          | 20.83                             | 28.5%                           | 73.03 |
| 1999                                    | 7.73          | 10.7%      | 29.13                   | 40.4%      | 43.03          | 59.6%          | 20.16                             | 27.9%                           | 72.17 |
| 2000                                    | 7.73          | 10.3%      | 30.99                   | 41.4%      | 43.96          | 58.6%          | 21.45                             | 28.6%                           | 74.95 |
| 2001                                    | 7.67          | 10.2%      | 30.38                   | 40.6%      | 44.48          | 59.4%          | 20.82                             | 27.8%                           | 74.86 |
| 2002                                    | 7.63          | 10.3%      | 28.72                   | 38.8%      | 45.31          | 61.2%          | 19.59                             | 26.5%                           | 74.03 |
| 2003                                    | 7.40          | 9.7%       | 30.45                   | 39.8%      | 46.11          | 60.2%          | 21.04                             | 27.5%                           | 76.57 |
| 2004                                    | 7.23          | 9.1%       | 33.04                   | 41.4%      | 46.81          | 58.6%          | 22.89                             | 28.7%                           | 79.85 |
| 2005                                    | 6.90          | 8.5%       | 34.75                   | 42.7%      | 46.62          | 57.3%          | 23.78                             | 29.2%                           | 81.37 |
| 2006                                    | 6.84          | 8.4%       | 34.55                   | 42.5%      | 46.77          | 57.5%          | 23.52                             | 28.9%                           | 81.31 |
| 2007                                    | 6.85          | 8.5%       | 34.24                   | 42.3%      | 46.76          | 57.7%          | 22.99                             | 28.4%                           | 81.00 |
| 2008                                    | 6.73          | 8.2%       | 35.57                   | 43.6%      | 46.07          | 56.4%          | 24.25                             | 29.7%                           | 81.64 |
| 2009                                    | 7.27          | 9.0%       | 33.70                   | 41.9%      | 46.67          | 58.1%          | 22.77                             | 28.3%                           | 80.36 |
| 2010                                    | 7.51          | 9.1%       | 34.92                   | 42.4%      | 47.51          | 57.6%          | 23.81                             | 28.9%                           | 82.43 |
| <i>Average annual percentage change</i> |               |            |                         |            |                |                |                                   |                                 |       |
| 1973–2010                               | -1.0%         |            | 0.4%                    |            | 1.4%           |                | 0.4%                              |                                 | 0.9%  |
| 2000–2010                               | -0.3%         |            | 1.2%                    |            | 0.8%           |                | 1.0%                              |                                 | 1.0%  |

**Source:**

U.S. Department of Energy, Energy Information Administration, *International Energy Statistics Website*, March 2011. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

<sup>a</sup> Includes natural gas plant liquids, crude oil and lease condensate. Does not account for all inputs or refinery processing gain.

<sup>b</sup> Organization of Petroleum Exporting Countries. See Glossary for membership.

<sup>c</sup> See Glossary for Persian Gulf Nations.





*The United States has accounted for almost one-quarter of the world's petroleum consumption for the last two decades, but in 2010 accounted for only 22.5%. World petroleum consumption decreased in 2009 but rose in 2010. Non-OECD consumption has continued to increase.*

**Table 1.4**  
**World Petroleum Consumption, 1960–2010**  
(millions barrels per day)

| Year                                    | United States | U.S. share | Total OECD <sup>a</sup> | Total non-OECD | World |
|---|---------------|------------|-------------------------|----------------|-------|
| 1960                                    | 9.80          | 45.9%      | 15.78                   | 5.56           | 21.34 |
| 1965                                    | 11.51         | 37.0%      | 22.81                   | 8.33           | 31.14 |
| 1970                                    | 14.70         | 31.4%      | 34.69                   | 12.12          | 46.81 |
| 1975                                    | 16.32         | 29.0%      | 39.14                   | 17.06          | 56.20 |
| 1976                                    | 17.46         | 29.3%      | 41.72                   | 17.95          | 59.67 |
| 1977                                    | 18.43         | 29.8%      | 42.78                   | 19.05          | 61.83 |
| 1978                                    | 18.85         | 29.4%      | 43.98                   | 20.18          | 64.16 |
| 1979                                    | 18.51         | 28.4%      | 44.39                   | 20.84          | 65.22 |
| 1980                                    | 17.06         | 27.0%      | 41.76                   | 21.35          | 63.11 |
| 1981                                    | 16.06         | 26.4%      | 39.49                   | 21.45          | 60.94 |
| 1982                                    | 15.30         | 25.7%      | 37.77                   | 21.78          | 59.54 |
| 1983                                    | 15.23         | 25.9%      | 36.91                   | 21.87          | 58.78 |
| 1984                                    | 15.73         | 26.3%      | 37.69                   | 22.12          | 59.82 |
| 1985                                    | 15.73         | 26.2%      | 37.48                   | 22.60          | 60.09 |
| 1986                                    | 16.28         | 26.3%      | 38.60                   | 23.21          | 61.81 |
| 1987                                    | 16.67         | 26.4%      | 39.34                   | 23.75          | 63.10 |
| 1988                                    | 17.28         | 26.6%      | 40.65                   | 24.31          | 64.97 |
| 1989                                    | 17.33         | 26.2%      | 41.33                   | 24.75          | 66.08 |
| 1990                                    | 16.99         | 25.5%      | 41.61                   | 25.07          | 66.68 |
| 1991                                    | 16.71         | 24.8%      | 42.00                   | 25.28          | 67.28 |
| 1992                                    | 17.03         | 25.2%      | 42.95                   | 24.52          | 67.46 |
| 1993                                    | 17.24         | 25.5%      | 43.30                   | 24.30          | 67.60 |
| 1994                                    | 17.72         | 25.7%      | 44.44                   | 24.43          | 68.86 |
| 1995                                    | 17.73         | 25.3%      | 44.90                   | 25.17          | 70.07 |
| 1996                                    | 18.31         | 25.6%      | 45.98                   | 25.65          | 71.63 |
| 1997                                    | 18.62         | 25.4%      | 46.78                   | 26.66          | 73.43 |
| 1998                                    | 18.92         | 25.5%      | 46.94                   | 27.13          | 74.07 |
| 1999                                    | 19.52         | 25.8%      | 47.87                   | 27.89          | 75.76 |
| 2000                                    | 19.70         | 25.7%      | 48.20                   | 28.57          | 76.77 |
| 2001                                    | 19.65         | 25.4%      | 48.26                   | 29.25          | 77.51 |
| 2002                                    | 19.76         | 25.3%      | 48.22                   | 29.94          | 78.16 |
| 2003                                    | 20.03         | 25.1%      | 48.91                   | 30.81          | 79.72 |
| 2004                                    | 20.73         | 25.1%      | 49.73                   | 32.78          | 82.51 |
| 2005                                    | 20.80         | 24.7%      | 50.13                   | 33.96          | 84.09 |
| 2006                                    | 20.69         | 24.3%      | 49.82                   | 35.35          | 85.17 |
| 2007                                    | 20.68         | 24.1%      | 49.57                   | 36.24          | 85.81 |
| 2008                                    | 19.50         | 22.9%      | 47.86                   | 37.40          | 85.26 |
| 2009                                    | 18.77         | 22.3%      | 45.72                   | 38.41          | 84.13 |
| 2010                                    | 19.15         | 22.5%      | 46.24                   | 39.02          | 85.26 |
| <i>Average annual percentage change</i> |               |            |                         |                |       |
| 1960–2010                               | 1.3%          |            | 2.2%                    | 4.0%           | 2.8%  |
| 1970–2010                               | 0.7%          |            | 0.7%                    | 3.0%           | 1.5%  |
| 2000–2010                               | -0.3%         |            | -0.4%                   | 3.2%           | 1.1%  |

**Source:**

U.S. Department of Energy, Energy Information Administration, *International Energy Statistics Website*, April 2011. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

<sup>a</sup> Organization for Economic Cooperation and Development. See Glossary for membership.



Figure 1.1. World Oil Reserves, Production and Consumption, 2009

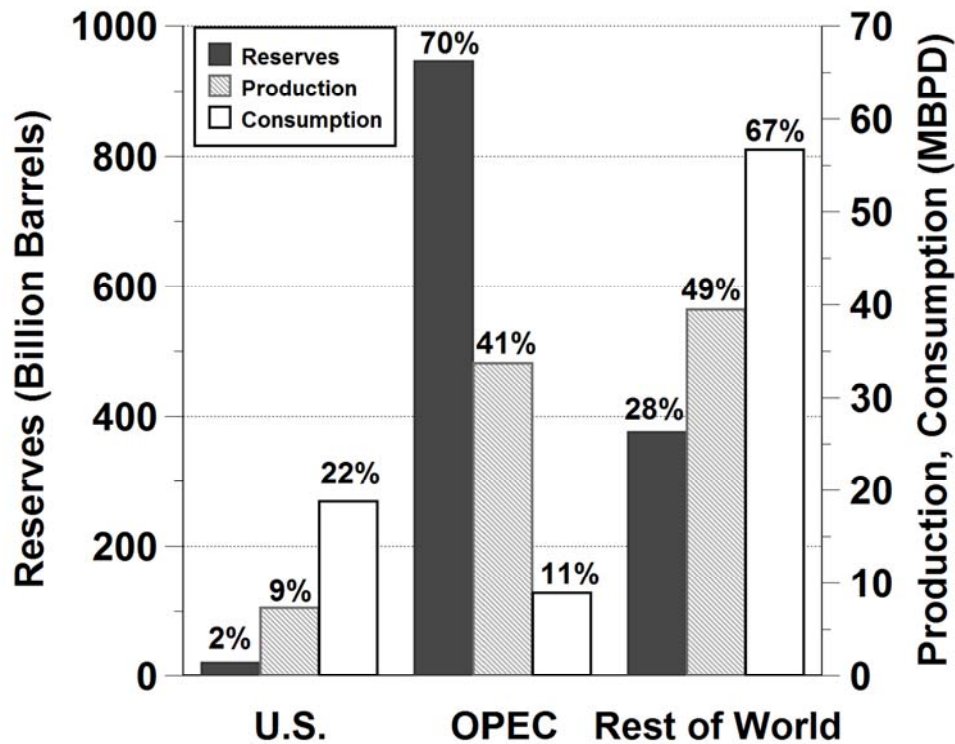


Table 1.5  
World Oil Reserves, Production and Consumption, 2009

|               | Crude oil<br>reserves<br>(billion<br>barrels) | Reserve<br>share | Petroleum<br>production<br>(million<br>barrels per<br>day) | Production<br>share | Petroleum<br>consumption<br>(million<br>barrels per<br>day) | Consumption<br>share |
|---------------|---|------------------|--|---------------------|---|----------------------|
| United States | 20.7  | 2%               | 7.3  | 9%                  | 18.8  | 22%                  |
| OPEC          | 946   | 70%              | 33.7   | 41%                 | 8.9   | 11%                  |
| Rest of world | 375.9   | 28%              | 39.5   | 49%                 | 56.7  | 67%                  |

**Sources:**

Reserves – Energy Information Administration, *International Energy Statistics*, April 2011.

Production – Energy Information Administration, *International Petroleum Monthly*, December 2010, Tables 1.1c, 1.1d, 1.3, and 1.7.

Consumption – Energy Information Administration, *International Energy Statistics*, April 2011, and *International Petroleum Monthly*, March 2011, Table 1.7. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

**Note:** Total consumption is higher than total production due to refinery gains including alcohol and liquid products produced from coal and other sources. OPEC countries include Venezuela, Iran, Iraq, Kuwait, Qatar, Saudi Arabia, Angola, United Arab Emirates, Algeria, Libya, Nigeria, Indonesia, Gabon, and Ecuador.



Figure 1.2. World Natural Gas Reserves, Production and Consumption, 2009

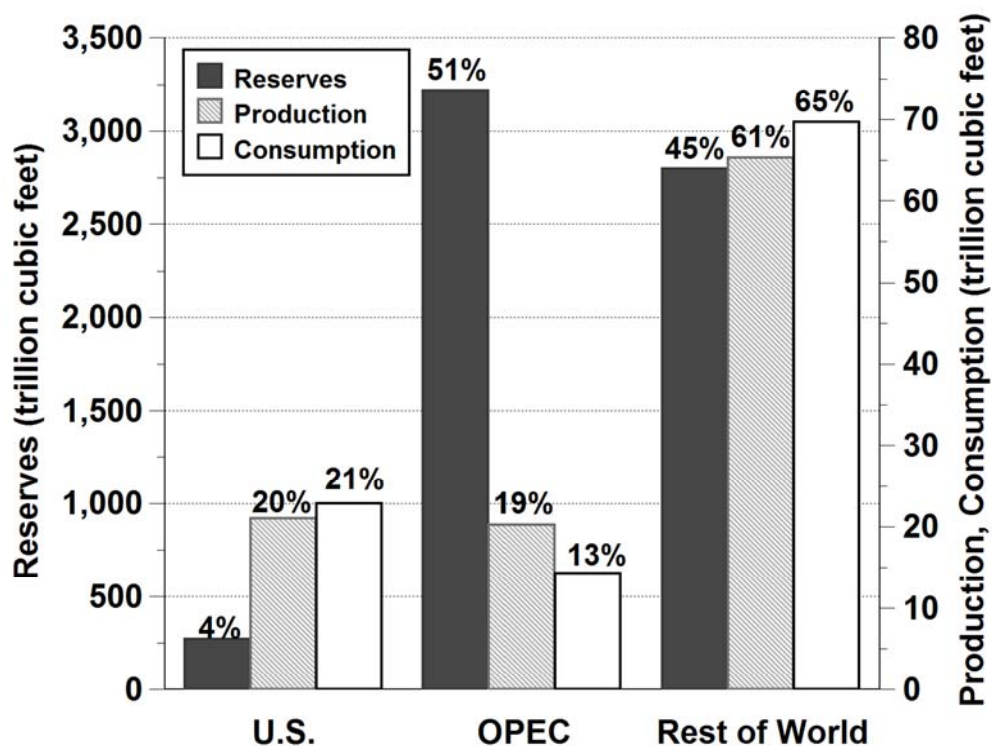


Table 1.6  
World Natural Gas Reserves, Production and Consumption, 2009  
(trillion cubic feet)

|               | Natural<br>gas<br>reserves | Reserve<br>share | Natural gas<br>production | Production<br>share | Natural gas<br>consumption | Consumption<br>share |
|---------------|----------------------------|------------------|---------------------------|---------------------|----------------------------|----------------------|
| U.S.          | 272.5                      | 4%               | 21.0                      | 20%                 | 22.8                       | 21%                  |
| OPEC          | 3,217.0                    | 51%              | 20.2                      | 19%                 | 14.3                       | 13%                  |
| Rest of world | 2,799.6                    | 45%              | 65.3                      | 61%                 | 69.7                       | 65%                  |

**Source:**

Energy Information Administration, *International Energy Statistics*, 2011. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

**Note:** Reserves as of May 2011. Production data are dry gas production.



*The share of petroleum imported to the United States can be calculated using total imports or net imports. Net imports, which are the preferred data, rose to 50% of U.S. petroleum consumption for the first time in 1998, while total imports reached 50% for the first time in 1993. OPEC share of net imports has been below 50% since 1993.*

**Table 1.7**  
**U.S. Petroleum Imports by World Region of Origin, 1960–2010**  
(million barrels per day)

| Year                                    | Net OPEC <sup>a</sup><br>imports | Net OPEC<br>share | Net Persian<br>Gulf nation <sup>b</sup><br>imports | Net Persian<br>Gulf share | Net<br>imports | Net imports as a<br>share of U.S.<br>consumption | Total<br>imports |
|---|----------------------------------|-------------------|--|---------------------------|----------------|--|------------------|
| 1960                                    | 1.31                             | 81.3%             | c  | c                         | 1.61           | c  | 1.82             |
| 1965                                    | 1.48                             | 64.7%             | c  | c                         | 2.28           | c  | 2.47             |
| 1970                                    | 1.34                             | 42.5%             | c  | c                         | 3.16           | c  | 3.42             |
| 1975                                    | 3.60                             | 61.6%             | 1.17   | 19.2%                     | 5.85           | 35.8%  | 6.06             |
| 1980                                    | 4.30                             | 62.2%             | 1.52   | 22.0%                     | 6.36           | 37.3%  | 6.91             |
| 1981                                    | 3.32                             | 55.4%             | 1.22   | 20.3%                     | 5.40           | 33.6%  | 6.00             |
| 1982                                    | 2.15                             | 42.0%             | 0.70   | 13.7%                     | 4.30           | 28.1%  | 5.11             |
| 1983                                    | 1.86                             | 36.9%             | 0.44   | 8.7%                      | 4.31           | 28.2%  | 5.05             |
| 1984                                    | 2.05                             | 37.7%             | 0.51   | 9.4%                      | 4.72           | 29.9%  | 5.44             |
| 1985                                    | 1.83                             | 36.1%             | 0.31   | 6.1%                      | 4.29           | 27.3%  | 5.07             |
| 1986                                    | 2.84                             | 45.6%             | 0.91   | 14.6%                     | 5.44           | 33.4%  | 6.22             |
| 1987                                    | 3.06                             | 45.8%             | 1.08   | 16.2%                     | 5.91           | 35.4%  | 6.68             |
| 1988                                    | 3.52                             | 47.6%             | 1.54   | 20.8%                     | 6.59           | 38.0%  | 7.40             |
| 1989                                    | 4.14                             | 51.4%             | 1.86   | 23.1%                     | 7.20           | 41.3%  | 8.06             |
| 1990                                    | 4.30                             | 53.6%             | 1.97   | 24.6%                     | 7.16           | 42.2%  | 8.02             |
| 1991                                    | 4.09                             | 53.7%             | 1.84   | 24.1%                     | 6.63           | 38.9%  | 7.63             |
| 1992                                    | 4.09                             | 51.9%             | 1.78   | 22.6%                     | 6.94           | 40.9%  | 7.89             |
| 1993                                    | 4.27                             | 49.6%             | 1.78   | 20.6%                     | 7.62           | 44.9%  | 8.62             |
| 1994                                    | 4.25                             | 47.2%             | 1.73   | 19.2%                     | 8.05           | 45.7%  | 9.00             |
| 1995                                    | 4.00                             | 45.3%             | 1.57   | 17.8%                     | 7.89           | 44.5%  | 8.84             |
| 1996                                    | 4.21                             | 44.4%             | 1.60   | 16.9%                     | 8.50           | 46.4%  | 9.48             |
| 1997                                    | 4.57                             | 45.0%             | 1.76   | 17.3%                     | 9.16           | 49.2%  | 10.16            |
| 1998                                    | 4.91                             | 45.8%             | 2.14   | 19.9%                     | 9.76           | 51.6%  | 10.71            |
| 1999                                    | 4.95                             | 45.6%             | 2.46   | 22.7%                     | 9.91           | 50.8%  | 10.85            |
| 2000                                    | 5.20                             | 45.4%             | 2.49   | 21.7%                     | 10.42          | 52.9%  | 11.46            |
| 2001                                    | 5.53                             | 46.6%             | 2.76   | 23.3%                     | 10.90          | 55.5%  | 11.87            |
| 2002                                    | 4.61                             | 39.9%             | 2.27   | 19.7%                     | 10.55          | 53.4%  | 11.53            |
| 2003                                    | 5.16                             | 42.1%             | 2.50   | 20.4%                     | 11.24          | 56.1%  | 12.26            |
| 2004                                    | 5.70                             | 43.4%             | 2.49   | 19.0%                     | 12.10          | 58.4%  | 13.15            |
| 2005                                    | 5.59                             | 40.7%             | 2.33   | 17.0%                     | 12.55          | 60.3%  | 13.71            |
| 2006                                    | 5.52                             | 40.2%             | 2.21   | 16.1%                     | 12.39          | 59.9%  | 13.71            |
| 2007                                    | 5.98                             | 44.4%             | 2.16   | 16.1%                     | 12.04          | 58.2%  | 13.47            |
| 2008                                    | 5.95                             | 46.1%             | 2.37   | 18.4%                     | 11.11          | 57.0%  | 12.92            |
| 2009                                    | 4.78                             | 40.9%             | 1.69   | 14.4%                     | 9.67           | 51.5%  | 11.69            |
| 2010                                    | 4.89                             | 41.6%             | 1.71   | 14.5%                     | 9.44           | 49.3%  | 11.73            |
| <i>Average annual percentage change</i> |                                  |                   |  |                           |                |  |                  |
| 1960–2010                               | 2.7%                             |                   | c  |                           | 3.6%           |  | 3.8%             |
| 1970–2010                               | 3.3%                             |                   | c  |                           | 2.8%           |  | 3.1%             |
| 2000–2010                               | -0.6%                            |                   | -3.7%  |                           | -1.0%          |  | 0.2%             |

**Source:**

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, Washington, DC, March 2011, Table 3.3a.

<sup>a</sup> Organization of Petroleum Exporting Countries. See Glossary for membership.

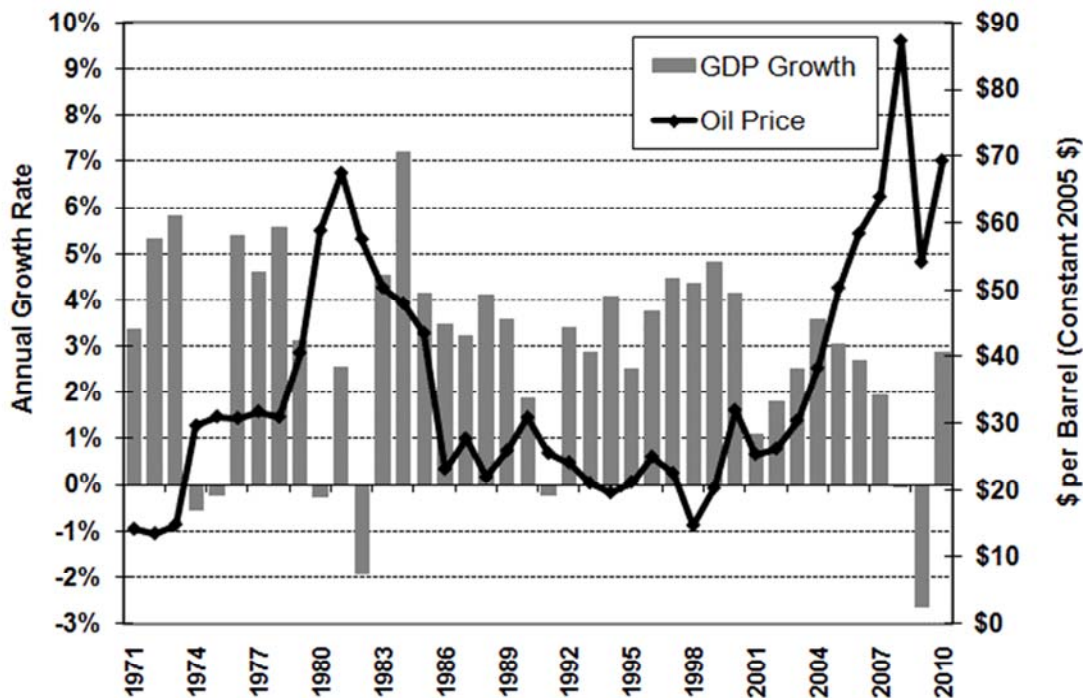
<sup>b</sup> See Glossary for Persian Gulf Nations.

<sup>c</sup> Data are not available.



Major oil price shocks have disrupted world energy markets five times in the past 30 years (1973-74, 1979-80, 1990-91, 1999-2000, 2008). Most of the oil price shocks were followed by an economic recession in the United States.

**Figure 1.3. Oil Price and Economic Growth, 1970–2010**



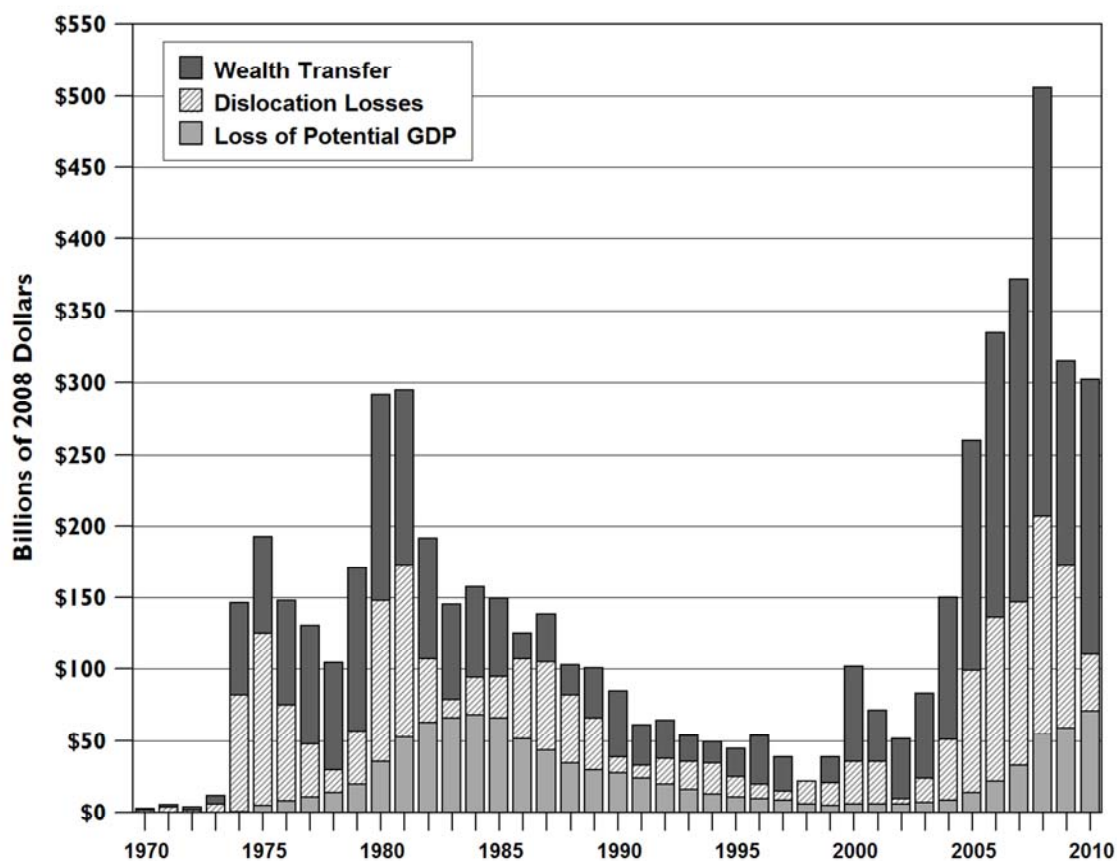
**Source:**

Greene, D.L. and N. I. Tishchishyna, *Costs of Oil Dependence: A 2000 Update*, Oak Ridge National Laboratory, ORNL/TM-2000/152, Oak Ridge, TN, 2000, and data updates, 2011. (Additional resources: [www-cta.ornl.gov/publications](http://www-cta.ornl.gov/publications))



The United States has long recognized the problem of oil dependence and the economic problems that arise from it. According to Oak Ridge National Laboratory (ORNL) researchers Greene and Hopson, oil dependence is a combination of four factors: (1) a noncompetitive world oil market strongly influenced by the OPEC cartel, (2) high levels of U.S. imports, (3) the importance of oil to the U.S. economy, and (4) the lack of economical and readily available substitutes for oil. ORNL developed a model to estimate the historical cost of oil dependence and analyze the potential effectiveness of policies on likely future costs. The most recent study using this model shows that the U.S. economy suffered the greatest losses in 2008 when wealth transfer and GDP losses (combined) amounted to approximately half a trillion dollars. However, when comparing oil dependence to the size of the economy, the year 1980 is the highest. Oil dependence costs were almost 4.5% of GDP in 1980, but were under 3.5% in 2008. In 2009, the average oil price fell to about \$60 per barrel and oil dependence costs fell to about \$300 billion for 2009 and 2010.

**Figure 1.4. Costs of Oil Dependence to the U.S. Economy, 1970–2010**



**Source:**

Greene, David L., Roderick Lee, and Janet L. Hopson, "OPEC and the Costs to the U.S. Economy of Oil Dependence: 1970-2010," Oak Ridge National Laboratory Memorandum, 2011.

**Notes:**

**Wealth Transfer** is the product of total U.S. oil imports and the difference between the actual market price of oil (influenced by market power) and what the price would have been in a competitive market.

**Dislocation Losses** are temporary reductions in GDP as a result of oil price shocks.

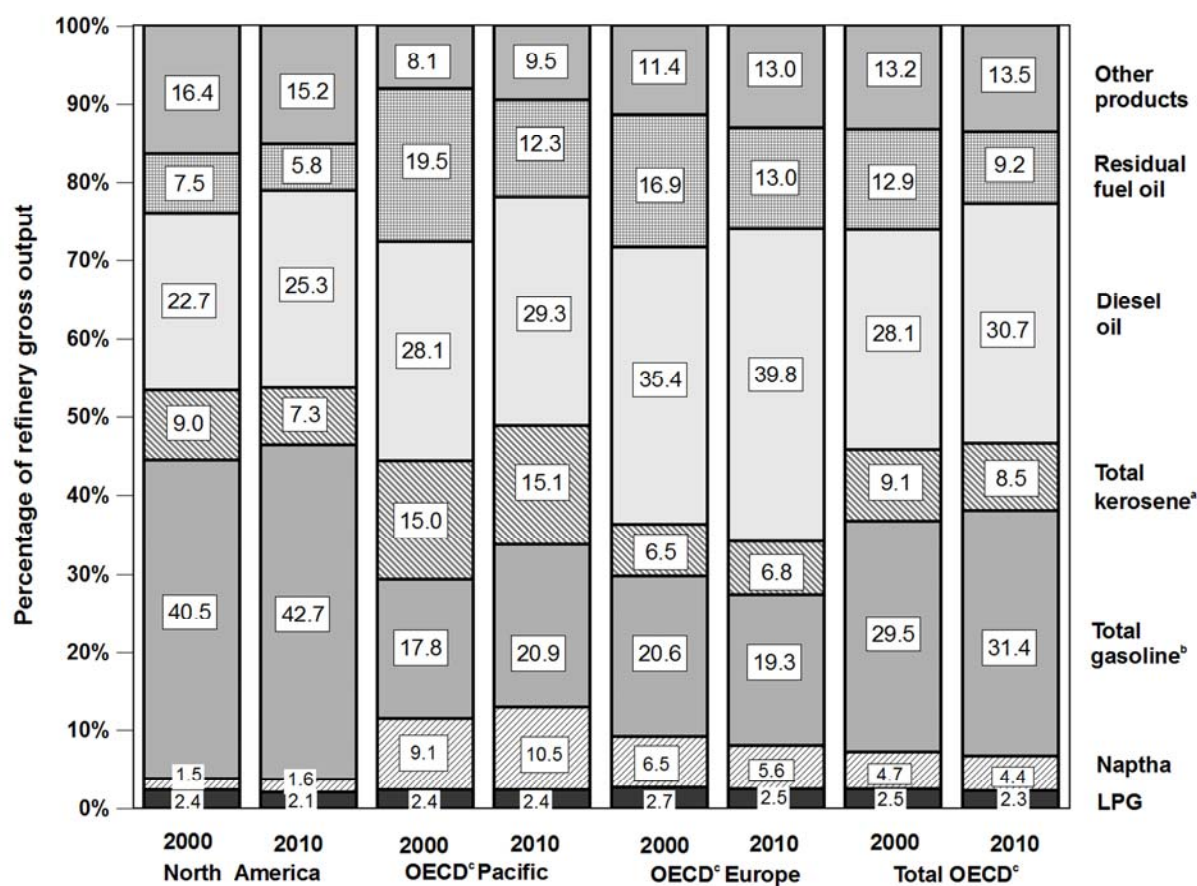
**Loss of Potential Gross Domestic Product (GDP)** results because a basic resource used by the economy to produce output has become more expensive. As a consequence, with the same endowment of labor, capital, and other resources, our economy cannot produce quite as much as it could have at a lower oil price.





*Other parts of the world refine crude oil to produce more diesel fuel and less gasoline than does North America. The OECD Europe countries produce the lowest share of gasoline in 2010.*

**Figure 1.5. Refinery Gross Output by World Region, 2000 and 2010**



**Source:**

International Energy Agency, *Monthly Oil Survey*, January 2011. (Additional resources: [www.iea.org](http://www.iea.org))

<sup>a</sup> Includes jet kerosene and other kerosene.

<sup>b</sup> Includes motor gasoline, jet gasoline, and aviation gasoline.

<sup>c</sup> Organization for Economic Cooperation and Development. See Glossary for membership.



*Oxygenate refinery input increased significantly in 1995, most certainly due to the Clean Air Act Amendments of 1990 which mandated the sale of reformulated gasoline in certain areas beginning in January 1995. The use of MTBE has declined in recent years due to many states banning the additive. The other hydrocarbons and liquids category includes unfinished oils, motor gasoline blending components and aviation gasoline blending components. In 2005 the gasoline blending components rose significantly.*

**Table 1.8**  
**U.S. Refinery Input of Crude Oil and Petroleum Products, 1987–2009**  
(thousand barrels)

| Year                                    | Crude oil | Natural gas liquids | Oxygenates   |                   |                               | Other hydrocarbons and liquids | Total input to refineries |
|---|-----------|---------------------|--------------|-------------------|-------------------------------|--------------------------------|---------------------------|
|   |           |                     | Fuel ethanol | MTBE <sup>a</sup> | Other oxygenates <sup>b</sup> |                                |                           |
| 1987                                    | 4,691,783 | 280,889             | c            | c                 | d                             | 132,720                        | 5,105,392                 |
| 1988                                    | 4,848,175 | 304,566             | c            | c                 | d                             | 105,645                        | 5,258,386                 |
| 1989                                    | 4,891,381 | 182,109             | c            | c                 | d                             | 223,797                        | 5,297,287                 |
| 1990                                    | 4,894,379 | 170,589             | c            | c                 | d                             | 260,108                        | 5,325,076                 |
| 1991                                    | 4,855,016 | 172,306             | c            | c                 | d                             | 280,265                        | 5,307,587                 |
| 1992                                    | 4,908,603 | 171,701             | c            | c                 | d                             | 272,676                        | 5,352,980                 |
| 1993                                    | 4,968,641 | 179,213             | 3,351        | 49,393            | 1,866                         | 280,074                        | 5,482,538                 |
| 1994                                    | 5,061,111 | 169,868             | 3,620        | 52,937            | 1,918                         | 193,808                        | 5,483,262                 |
| 1995                                    | 5,100,317 | 172,026             | 9,055        | 79,396            | 4,122                         | 190,411                        | 5,555,327                 |
| 1996                                    | 5,195,265 | 164,552             | 11,156       | 79,407            | 3,570                         | 214,282                        | 5,668,232                 |
| 1997                                    | 5,351,466 | 151,769             | 11,803       | 86,240            | 4,246                         | 201,268                        | 5,806,792                 |
| 1998                                    | 5,434,383 | 146,921             | 11,722       | 89,362            | 4,038                         | 206,135                        | 5,892,561                 |
| 1999                                    | 5,403,450 | 135,756             | 13,735       | 94,784            | 4,147                         | 225,779                        | 5,877,651                 |
| 2000                                    | 5,514,395 | 138,921             | 15,268       | 90,288            | 4,005                         | 201,135                        | 5,964,012                 |
| 2001                                    | 5,521,637 | 156,479             | 16,929       | 87,116            | 4,544                         | 192,632                        | 5,979,337                 |
| 2002                                    | 5,455,530 | 155,429             | 26,320       | 90,291            | 2,338                         | 224,567                        | 5,955,475                 |
| 2003                                    | 5,585,875 | 152,763             | 55,626       | 67,592            | 1,937                         | 163,459                        | 6,027,252                 |
| 2004                                    | 5,663,861 | 154,356             | 74,095       | 47,600            | 940                           | 194,203                        | 6,135,055                 |
| 2005                                    | 5,555,332 | 161,037             | 84,088       | 39,751            | 612                           | 295,064                        | 6,135,884                 |
| 2006                                    | 5,563,354 | 182,924             | 117,198      | 11,580            | 57                            | 322,989                        | 6,198,102                 |
| 2007                                    | 5,532,097 | 184,383             | 136,603      | 1,610             | 0                             | 349,807                        | 6,204,500                 |
| 2008                                    | 5,361,287 | 177,559             | 190,084      | 480               | 0                             | 548,843                        | 6,277,893                 |
| 2009                                    | 5,232,656 | 177,194             | 240,955      | 90                | 0                             | 518,998                        | 6,169,893                 |
| <i>Average annual percentage change</i> |           |                     |              |                   |                               |                                |                           |
| 1987–2009                               | 1.3%      | -2.1%               | d            | d                 | d                             | 6.4%                           | 0.9%                      |
| 1999–2009                               | -0.3%     | 2.7%                | 33.2%        | -50.1%            | -100.0%                       | 8.7%                           | 0.5%                      |

**Source:**

U.S. Department of Energy, Energy Information Administration, *Petroleum Supply Annual 2009*, Vol. 1, July 2010, Table 15, and annual. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

<sup>a</sup> Methyl tertiary butyl ether (MTBE).

<sup>b</sup> Includes methanol and other oxygenates.

<sup>c</sup> Reported in “Other” category in this year.

<sup>d</sup> Data are not available.





*When crude oil and other hydrocarbons are processed into products that are, on average, less dense than the input, a processing volume gain occurs. Due to this gain, the product yield from a barrel of crude oil is more than 100%. The processing volume gain has been growing over the years.*

**Table 1.9**  
**Refinery Yield of Petroleum Products from a Barrel of Crude Oil, 1978–2010**  
(percentage)

| Year | Motor gasoline | Distillate fuel oil | Jet fuel | Liquified petroleum gas | Other <sup>a</sup> | Total <sup>b</sup> |
|------|----------------|---------------------|----------|-------------------------|--------------------|--------------------|
| 1978 | 44.1           | 21.4                | 6.6      | 2.3                     | 29.6               | 104.0              |
| 1979 | 43.0           | 21.5                | 6.9      | 2.3                     | 30.3               | 104.0              |
| 1980 | 44.5           | 19.7                | 7.4      | 2.4                     | 30.0               | 104.0              |
| 1981 | 44.8           | 20.5                | 7.6      | 2.4                     | 28.7               | 104.0              |
| 1982 | 46.4           | 21.5                | 8.1      | 2.2                     | 26.2               | 104.4              |
| 1983 | 47.6           | 20.5                | 8.5      | 2.7                     | 24.8               | 104.1              |
| 1984 | 46.7           | 21.5                | 9.1      | 2.9                     | 24.2               | 104.4              |
| 1985 | 45.6           | 21.6                | 9.6      | 3.1                     | 24.6               | 104.5              |
| 1986 | 45.7           | 21.2                | 9.8      | 3.2                     | 24.8               | 104.7              |
| 1987 | 46.4           | 20.5                | 10.0     | 3.4                     | 24.5               | 104.8              |
| 1988 | 46.0           | 20.8                | 10.0     | 3.6                     | 24.4               | 104.8              |
| 1989 | 45.7           | 20.8                | 10.1     | 4.0                     | 24.2               | 104.8              |
| 1990 | 45.6           | 20.9                | 10.7     | 3.6                     | 24.1               | 104.9              |
| 1991 | 45.7           | 21.3                | 10.3     | 3.8                     | 24.1               | 105.2              |
| 1992 | 46.0           | 21.2                | 9.9      | 4.3                     | 24.0               | 105.4              |
| 1993 | 46.1           | 21.9                | 9.2      | 4.1                     | 23.3               | 104.6              |
| 1994 | 45.5           | 22.3                | 9.8      | 4.2                     | 23.2               | 105.0              |
| 1995 | 46.4           | 21.8                | 9.7      | 4.5                     | 22.8               | 105.2              |
| 1996 | 45.7           | 22.7                | 10.4     | 4.5                     | 22.4               | 105.7              |
| 1997 | 45.7           | 22.5                | 10.3     | 4.6                     | 22.4               | 105.5              |
| 1998 | 46.2           | 22.3                | 9.9      | 4.4                     | 22.9               | 105.7              |
| 1999 | 46.5           | 22.3                | 10.2     | 4.5                     | 22.4               | 105.9              |
| 2000 | 46.2           | 23.1                | 10.3     | 4.5                     | 22.0               | 106.1              |
| 2001 | 46.2           | 23.8                | 9.8      | 4.3                     | 21.6               | 105.7              |
| 2002 | 47.3           | 23.2                | 9.8      | 4.3                     | 21.5               | 106.1              |
| 2003 | 46.9           | 23.7                | 9.5      | 4.2                     | 22.1               | 106.4              |
| 2004 | 46.8           | 23.9                | 9.7      | 4.0                     | 22.2               | 106.6              |
| 2005 | 46.2           | 25.0                | 9.8      | 3.6                     | 21.6               | 106.2              |
| 2006 | 45.8           | 25.4                | 9.3      | 3.9                     | 21.7               | 106.1              |
| 2007 | 45.5           | 26.1                | 9.1      | 4.1                     | 21.5               | 106.3              |
| 2008 | 44.2           | 27.8                | 9.7      | 4.1                     | 20.7               | 106.5              |
| 2009 | 46.1           | 26.9                | 9.3      | 4.1                     | 20.2               | 106.6              |
| 2010 | 45.7           | 27.5                | 9.3      | 4.3                     | 20.3               | 107.1              |

**Source:**

Department of Energy, Energy Information Administration, *Petroleum Supply Navigator*, Vol.1, March 2011.  
(Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

<sup>a</sup> Includes aviation gasoline (0.1%), kerosene (0.1%), residual fuel oil (4.0%), naphtha and other oils for petrochemical feedstock use (1.0%), other oils for petrochemical feedstock use (1.0%), special naphthas (0.2%), lubricants (1.0%), waxes (0.1%), petroleum coke (5.3%) asphalt and road oil (2.4%), still gas (4.3%), and miscellaneous products (0.5%).

<sup>b</sup> Products sum greater than 100% due to processing gain. The processing gain for years 1978 to 1980 is assumed to be 4 percent.



*Domestic petroleum production increased in 2009 for the first time in 20 years. Most of the petroleum imported by the United States is in the form of crude oil. The United States does export small amounts of petroleum, mainly refined petroleum products which go to Canada and Mexico.*

**Table 1.10**  
**United States Petroleum Production, Imports and Exports, 1950–2010**  
(million barrels per day)

|   | Domestic Production |                           |                    | Net Imports |                    |       | Exports   |                    |       |
|---|---------------------|---------------------------|--------------------|-------------|--------------------|-------|-----------|--------------------|-------|
|   | Crude oil           | Natural gas plant liquids | Total <sup>a</sup> | Crude oil   | Petroleum products | Total | Crude oil | Petroleum products | Total |
| 1950                                    | 5.41                | 0.50                      | 5.91               | 0.49        | 0.36               | 0.85  | 0.10      | 0.21               | 0.31  |
| 1955                                    | 6.81                | 0.77                      | 7.58               | 0.78        | 0.47               | 1.25  | 0.03      | 0.34               | 0.37  |
| 1960                                    | 7.05                | 0.93                      | 7.98               | 1.02        | 0.80               | 1.82  | 0.01      | 0.19               | 0.20  |
| 1965                                    | 7.80                | 1.21                      | 9.01               | 1.24        | 1.23               | 2.47  | 0.00      | 0.18               | 0.19  |
| 1970                                    | 9.64                | 1.66                      | 11.30              | 1.32        | 2.10               | 3.42  | 0.01      | 0.25               | 0.26  |
| 1975                                    | 8.38                | 1.63                      | 10.01              | 4.11        | 1.95               | 6.06  | 0.01      | 0.20               | 0.21  |
| 1980                                    | 8.60                | 1.57                      | 10.17              | 5.26        | 1.65               | 6.91  | 0.29      | 0.26               | 0.54  |
| 1981                                    | 8.57                | 1.61                      | 10.18              | 4.40        | 1.60               | 6.00  | 0.23      | 0.37               | 0.60  |
| 1982                                    | 8.65                | 1.55                      | 10.20              | 3.49        | 1.63               | 5.11  | 0.24      | 0.58               | 0.82  |
| 1983                                    | 8.69                | 1.56                      | 10.25              | 3.33        | 1.72               | 5.05  | 0.16      | 0.58               | 0.74  |
| 1984                                    | 8.90                | 1.63                      | 10.53              | 3.43        | 2.01               | 5.44  | 0.18      | 0.54               | 0.72  |
| 1985                                    | 8.97                | 1.61                      | 10.58              | 3.20        | 1.87               | 5.07  | 0.20      | 0.58               | 0.78  |
| 1986                                    | 8.68                | 1.55                      | 10.23              | 4.18        | 2.05               | 6.22  | 0.15      | 0.63               | 0.79  |
| 1987                                    | 8.35                | 1.60                      | 9.95               | 4.67        | 2.00               | 6.68  | 0.15      | 0.61               | 0.76  |
| 1988                                    | 8.16                | 1.63                      | 9.97               | 5.11        | 2.30               | 7.40  | 0.16      | 0.66               | 0.82  |
| 1989                                    | 7.61                | 1.55                      | 9.16               | 5.84        | 2.22               | 8.06  | 0.14      | 0.72               | 0.86  |
| 1990                                    | 7.36                | 1.56                      | 8.91               | 5.89        | 2.12               | 8.02  | 0.11      | 0.75               | 0.86  |
| 1991                                    | 7.42                | 1.66                      | 9.08               | 5.78        | 1.84               | 7.63  | 0.12      | 0.89               | 1.00  |
| 1992                                    | 7.18                | 1.70                      | 8.88               | 6.08        | 1.81               | 7.89  | 0.09      | 0.86               | 0.95  |
| 1993                                    | 6.85                | 1.74                      | 8.59               | 6.79        | 1.83               | 8.62  | 0.10      | 0.90               | 1.00  |
| 1994                                    | 6.66                | 1.73                      | 8.39               | 7.06        | 1.93               | 9.00  | 0.10      | 0.84               | 0.94  |
| 1995                                    | 6.56                | 1.76                      | 8.32               | 7.23        | 1.61               | 8.84  | 0.10      | 0.86               | 0.95  |
| 1996                                    | 6.47                | 1.83                      | 8.30               | 7.51        | 1.97               | 9.48  | 0.11      | 0.87               | 0.98  |
| 1997                                    | 6.45                | 1.82                      | 8.27               | 8.23        | 1.94               | 10.16 | 0.11      | 0.90               | 1.00  |
| 1998                                    | 6.25                | 1.76                      | 8.01               | 8.71        | 2.00               | 10.71 | 0.11      | 0.84               | 0.95  |
| 1999                                    | 5.88                | 1.85                      | 7.73               | 8.73        | 2.12               | 10.85 | 0.12      | 0.82               | 0.94  |
| 2000                                    | 5.82                | 1.91                      | 7.73               | 9.07        | 2.39               | 11.46 | 0.05      | 0.99               | 1.04  |
| 2001                                    | 5.80                | 1.87                      | 7.67               | 9.33        | 2.54               | 11.87 | 0.02      | 0.95               | 0.97  |
| 2002                                    | 5.75                | 1.88                      | 7.63               | 9.14        | 2.39               | 11.53 | 0.01      | 0.98               | 0.98  |
| 2003                                    | 5.68                | 1.72                      | 7.40               | 9.67        | 2.60               | 12.26 | 0.01      | 1.01               | 1.03  |
| 2004                                    | 5.42                | 1.81                      | 7.23               | 10.09       | 3.06               | 13.15 | 0.03      | 1.02               | 1.05  |
| 2005                                    | 5.18                | 1.72                      | 6.90               | 10.13       | 3.59               | 13.71 | 0.03      | 1.13               | 1.17  |
| 2006                                    | 5.10                | 1.74                      | 6.84               | 10.12       | 3.59               | 13.71 | 0.03      | 1.29               | 1.32  |
| 2007                                    | 5.06                | 1.78                      | 6.85               | 10.03       | 3.44               | 13.47 | 0.03      | 1.41               | 1.43  |
| 2008                                    | 4.95                | 1.78                      | 6.73               | 9.78        | 3.13               | 12.92 | 0.03      | 1.77               | 1.80  |
| 2009                                    | 5.36                | 1.91                      | 7.21               | 9.01        | 2.67               | 11.69 | 0.04      | 1.98               | 2.02  |
| 2010                                    | 5.51                | 2.00                      | 7.51               | 9.16        | 2.59               | 11.75 | 0.04      | 2.27               | 2.31  |
| <i>Average annual percentage change</i> |                     |                           |                    |             |                    |       |           |                    |       |
| 1950–2010                               | 0.0%                | 2.3%                      | 0.4%               | 5.0%        | 3.3%               | 4.5%  | -1.5%     | 4.0%               | 3.4%  |
| 1970–2010                               | -1.4%               | 0.5%                      | -1.0%              | 5.0%        | 0.5%               | 3.1%  | 3.5%      | 5.7%               | 5.6%  |
| 2000–2010                               | -0.5%               | 0.5%                      | -0.3%              | 0.1%        | 0.8%               | 0.3%  | -2.2%     | 8.7%               | 8.3%  |

**Source:**

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2011, Tables 3.1 and 3.3b and *Annual Energy Review*, Table 5.3.

<sup>a</sup> Total domestic production includes crude oil, natural gas plant liquids and small amounts of other liquids.



*The U.S. share of the world's petroleum consumption is slightly less than one-quarter. The United States relies heavily on imported petroleum. Imports accounted for nearly 50% of U.S. petroleum consumption in 2010.*

**Table 1.11**  
**Petroleum Production and Consumption and Some Important Percent Shares, 1950–2010**

|   | Domestic<br>petroleum<br>production <sup>a</sup> | Net<br>petroleum<br>imports | Transportation<br>petroleum<br>consumption | U.S.<br>petroleum<br>consumption | World<br>petroleum<br>consumption | Net imports<br>as a share of<br>U.S.<br>consumption | U.S. petroleum<br>consumption as<br>a share of world<br>consumption | Transportation<br>petroleum use as<br>a share of<br>domestic<br>production |
|---|--|-----------------------------|--|----------------------------------|-----------------------------------|---|---|--|
|   | (million barrels per day)                        |                             |  |                                  |                                   |   |   |  |
| 1950                                    | 5.91   | 0.55                        | 3.36                                       | 6.46                             | <sup>b</sup>                      | 8.4%  | <sup>b</sup>  | 56.8%  |
| 1955                                    | 7.58   | 0.88                        | 4.46                                       | 8.46                             | <sup>b</sup>                      | 10.4%   | <sup>b</sup>  | 58.8%  |
| 1960                                    | 7.99   | 1.62                        | 5.15                                       | 9.82                             | 21.34                             | 16.5%   | 46.0%   | 64.5%  |
| 1965                                    | 9.01   | 2.28                        | 6.04                                       | 11.51                            | 31.14                             | 19.8%   | 37.0%   | 67.0%  |
| 1970                                    | 11.30  | 3.16                        | 7.78                                       | 14.70                            | 46.81                             | 21.5%   | 31.4%   | 68.9%  |
| 1975                                    | 10.01  | 5.85                        | 8.95                                       | 16.32                            | 56.20                             | 35.8%   | 29.0%   | 89.4%  |
| 1980                                    | 10.17  | 6.36                        | 9.57                                       | 17.06                            | 63.11                             | 37.3%   | 27.0%   | 94.1%  |
| 1981                                    | 10.18  | 5.40                        | 9.49                                       | 16.06                            | 60.94                             | 33.6%   | 26.3%   | 93.2%  |
| 1982                                    | 10.20  | 4.30                        | 9.31                                       | 15.30                            | 59.54                             | 28.1%   | 25.7%   | 91.2%  |
| 1983                                    | 10.25  | 4.31                        | 9.41                                       | 15.23                            | 58.78                             | 28.3%   | 25.9%   | 91.8%  |
| 1984                                    | 10.51  | 4.72                        | 9.71                                       | 15.73                            | 59.82                             | 30.0%   | 26.3%   | 92.4%  |
| 1985                                    | 10.58  | 4.29                        | 9.84                                       | 15.73                            | 60.08                             | 27.3%   | 26.2%   | 93.0%  |
| 1986                                    | 10.23  | 5.44                        | 10.19                                      | 16.28                            | 61.81                             | 33.4%   | 26.3%   | 99.6%  |
| 1987                                    | 9.94   | 5.91                        | 10.50                                      | 16.67                            | 63.10                             | 35.5%   | 26.4%   | 105.7%   |
| 1988                                    | 9.76   | 6.59                        | 10.88                                      | 17.28                            | 64.97                             | 38.1%   | 26.6%   | 111.4%   |
| 1989                                    | 9.16   | 7.20                        | 10.94                                      | 17.33                            | 66.08                             | 41.6%   | 26.2%   | 119.4%   |
| 1990                                    | 8.91   | 7.16                        | 10.89                                      | 16.99                            | 66.63                             | 42.2%   | 25.5%   | 122.2%   |
| 1991                                    | 9.08   | 6.63                        | 10.76                                      | 16.71                            | 67.22                             | 39.6%   | 24.9%   | 118.5%   |
| 1992                                    | 8.87   | 6.94                        | 10.91                                      | 17.03                            | 67.39                             | 40.8%   | 25.3%   | 123.0%   |
| 1993                                    | 8.58   | 7.62                        | 11.12                                      | 17.24                            | 67.51                             | 44.2%   | 25.5%   | 129.7%   |
| 1994                                    | 8.39   | 8.05                        | 11.13                                      | 17.72                            | 68.78                             | 45.5%   | 25.8%   | 132.6%   |
| 1995                                    | 8.32   | 7.89                        | 11.61                                      | 17.73                            | 69.99                             | 44.5%   | 25.3%   | 139.5%   |
| 1996                                    | 8.30   | 8.50                        | 11.91                                      | 18.31                            | 71.54                             | 46.4%   | 25.6%   | 143.5%   |
| 1997                                    | 8.27   | 9.16                        | 12.05                                      | 18.62                            | 73.44                             | 49.2%   | 25.4%   | 145.7%   |
| 1998                                    | 8.01   | 9.76                        | 12.36                                      | 18.92                            | 74.08                             | 51.6%   | 25.5%   | 154.3%   |
| 1999                                    | 7.73   | 9.91                        | 12.70                                      | 19.52                            | 75.79                             | 50.8%   | 25.8%   | 164.3%   |
| 2000                                    | 7.73   | 10.42                       | 12.98                                      | 19.70                            | 76.77                             | 52.9%   | 25.7%   | 167.9%   |
| 2001                                    | 7.67   | 10.90                       | 12.86                                      | 19.65                            | 77.51                             | 55.5%   | 25.3%   | 167.7%   |
| 2002                                    | 7.63   | 10.55                       | 13.12                                      | 19.76                            | 78.16                             | 53.4%   | 25.3%   | 172.0%   |
| 2003                                    | 7.40   | 11.24                       | 13.20                                      | 20.03                            | 79.72                             | 56.1%   | 25.1%   | 178.4%   |
| 2004                                    | 7.23   | 12.10                       | 13.61                                      | 20.73                            | 82.51                             | 58.4%   | 25.1%   | 188.2%   |
| 2005                                    | 6.90   | 12.55                       | 13.79                                      | 20.80                            | 84.11                             | 60.3%   | 24.7%   | 199.9%   |
| 2006                                    | 6.84   | 12.39                       | 13.95                                      | 20.69                            | 85.26                             | 59.9%   | 24.3%   | 203.9%   |
| 2007                                    | 6.85   | 12.04                       | 14.00                                      | 20.68                            | 86.29                             | 58.2%   | 24.0%   | 204.4%   |
| 2008                                    | 6.73   | 11.11                       | 13.33                                      | 19.50                            | 85.78                             | 57.0%   | 22.7%   | 198.0%   |
| 2009                                    | 7.27   | 9.67                        | 12.82                                      | 18.77                            | 84.34                             | 51.5%   | 22.3%   | 176.4%   |
| 2010                                    | 7.51   | 9.44                        | 12.96                                      | 19.15                            | 85.26                             | 49.3%   | 22.5%   | 172.5%   |
| <i>Average annual percentage change</i> |  |                             |  |                                  |                                   |   |   |  |
| 1950–2010                               | 0.4%   | 4.9%                        | 2.3%                                       | 1.8%                             | <sup>b</sup>                      |   |   |  |
| 1970–2010                               | -1.0%  | 2.8%                        | 1.3%                                       | 0.7%                             | 1.5%                              |   |   |  |
| 2000–2010                               | -0.3%  | -1.0%                       | 0.0%                                       | -0.3%                            | 1.0%                              |   |   |  |

**Sources:**

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2011, Tables 2.5, 3.1, and A3. (Pre-1973 data from the *Annual Energy Review*). World petroleum consumption - U.S. Department of Energy, Energy Information Administration, *International Energy Statistics Website*, March 2011. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

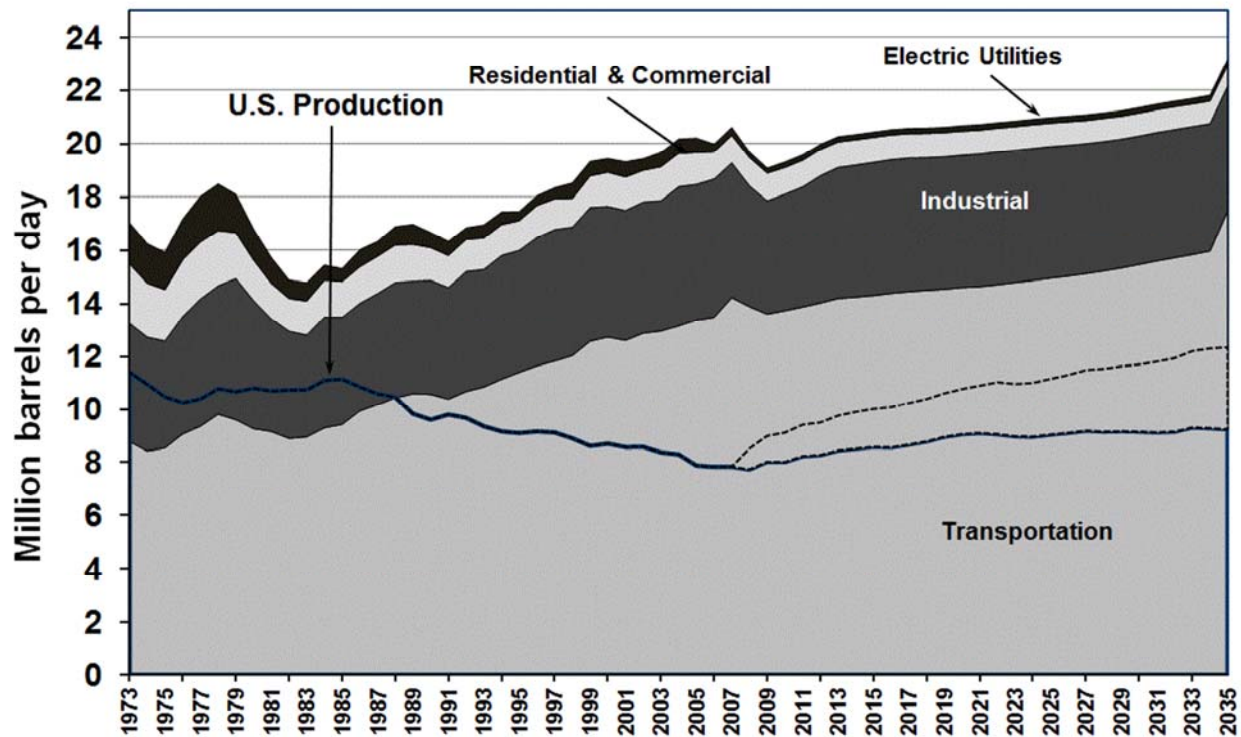
<sup>a</sup> Total domestic production includes crude oil, natural gas plant liquids and small amounts of other liquids.

<sup>b</sup> Data are not available.



Before 1989 the U.S. produced enough petroleum to meet the needs of the transportation sector, but was still short of meeting the petroleum needs of all the sectors, including industrial, residential and commercial, and electric utilities. In 1973 the gap between what the U.S. produced and what was consumed was 5.6 million barrels per day. By 2035, the gap is expected to be at least 10.8 million barrels per day if all sources of petroleum are included or 13.9 million barrels per day if only conventional petroleum sources are used.

**Figure 1.6. United States Petroleum Production and Consumption – All Sectors, 1973–2035**



**Source:**

See Tables 1.12 and 2.7. Projections are from the Energy Information Administration, *Annual Energy Outlook 2011*, April 2011.

**Notes:** The U.S. Production has two lines after 2005. The solid line is conventional sources of petroleum, including crude oil, natural gas plant liquids, and refinery gains. The dashed line adds in other non-petroleum sources, including ethanol, biomass, liquids from coal, other blending components, other hydrocarbons, and ethers.

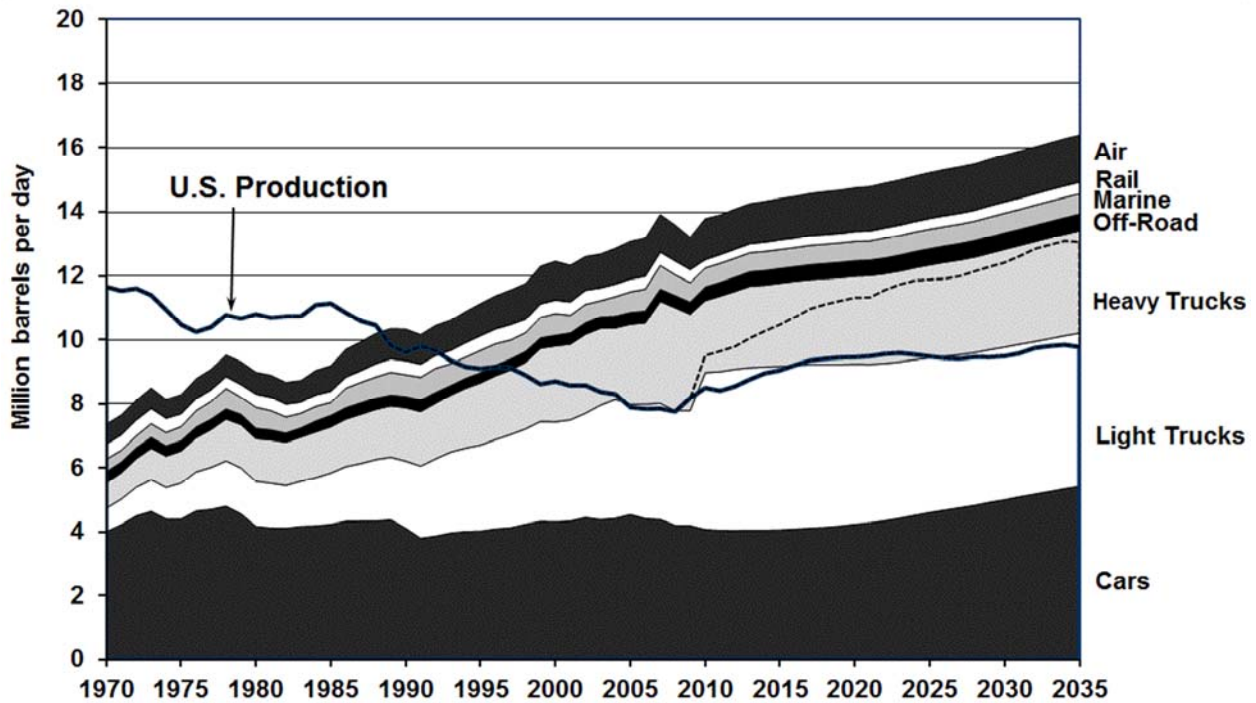
The sharp increase in values between 2006 and 2007 is the result of the FHWA's methodology change.

The data change from historical to projected values occurs between 2009 and 2010.



*In 1989 the transportation sector petroleum consumption surpassed U.S. petroleum production for the first time, creating a gap that must be met with imports of petroleum. By the year 2035, transportation petroleum consumption is expected to grow to more than 16 million barrels per day; at that time, the gap between U.S. production and transportation consumption will be about 3.8 million barrels per day (when including the non-petroleum sources).*

**Figure 1.7. United States Petroleum Production, Transportation and Consumption, 1970–2035**



**Source:**

See Tables 1.12 and 2.7. Projections are from the Energy Information Administration, *Annual Energy Outlook 2011*, April 2011.

**Notes:** The U.S. Production has two lines after 2005. The solid line is conventional sources of petroleum, including crude oil, natural gas plant liquids, and refinery gains. The dashed line adds in other non-petroleum sources, including ethanol, biomass, liquids from coal, other blending components, other hydrocarbons, and ethers.

The sharp increase in values between 2009 and 2010 are caused by the data change from historical to projected values. The sharp increase in the value for heavy trucks between 2006 and 2007 is the result of the FHWA's methodology change.



*Transportation accounted for almost 70% of the U.S. petroleum use in 2010. Total petroleum consumption reached more than 20 million barrels per day from 2004 to 2007, but has been below that level since then.*

**Table 1.12**  
**Consumption of Petroleum by End-Use Sector, 1973–2010**  
**(million barrels per day)**

| Year                                    | Transportation | Percentage | Residential | Commercial | Industrial | Electric utilities | Total |
|---|----------------|------------|-------------|------------|------------|--------------------|-------|
| 1973                                    | 9.05           | 52.3%      | 1.46        | 0.77       | 4.48       | 1.54               | 17.31 |
| 1974                                    | 8.84           | 53.1%      | 1.33        | 0.70       | 4.30       | 1.48               | 16.65 |
| 1975                                    | 8.95           | 54.8%      | 1.29        | 0.65       | 4.04       | 1.39               | 16.32 |
| 1976                                    | 9.40           | 53.7%      | 1.40        | 0.72       | 4.46       | 1.52               | 17.51 |
| 1977                                    | 9.76           | 52.9%      | 1.39        | 0.75       | 4.83       | 1.71               | 18.44 |
| 1978                                    | 10.16          | 53.9%      | 1.35        | 0.72       | 4.87       | 1.75               | 18.84 |
| 1979                                    | 10.00          | 54.0%      | 1.07        | 0.66       | 5.34       | 1.44               | 18.51 |
| 1980                                    | 9.57           | 56.0%      | 0.89        | 0.63       | 4.86       | 1.15               | 17.10 |
| 1981                                    | 9.49           | 59.1%      | 0.79        | 0.54       | 4.27       | 0.96               | 16.06 |
| 1982                                    | 9.31           | 60.8%      | 0.75        | 0.50       | 4.06       | 0.69               | 15.30 |
| 1983                                    | 9.41           | 61.8%      | 0.72        | 0.57       | 3.85       | 0.68               | 15.23 |
| 1984                                    | 9.62           | 61.0%      | 0.79        | 0.60       | 4.20       | 0.56               | 15.78 |
| 1985                                    | 9.84           | 62.6%      | 0.81        | 0.53       | 4.07       | 0.48               | 15.72 |
| 1986                                    | 10.19          | 62.6%      | 0.80        | 0.57       | 4.09       | 0.64               | 16.28 |
| 1987                                    | 10.51          | 63.0%      | 0.85        | 0.55       | 4.21       | 0.55               | 16.67 |
| 1988                                    | 10.88          | 62.7%      | 0.87        | 0.54       | 4.36       | 0.69               | 17.34 |
| 1989                                    | 10.94          | 62.8%      | 0.88        | 0.51       | 4.33       | 0.75               | 17.40 |
| 1990                                    | 10.89          | 64.7%      | 0.74        | 0.49       | 4.15       | 0.57               | 16.84 |
| 1991                                    | 10.76          | 63.2%      | 0.74        | 0.46       | 4.53       | 0.53               | 17.03 |
| 1992                                    | 10.91          | 64.2%      | 0.76        | 0.44       | 4.45       | 0.44               | 16.99 |
| 1993                                    | 11.08          | 63.7%      | 0.77        | 0.41       | 4.64       | 0.50               | 17.39 |
| 1994                                    | 11.36          | 64.7%      | 0.76        | 0.41       | 4.57       | 0.47               | 17.57 |
| 1995                                    | 11.61          | 64.9%      | 0.74        | 0.38       | 4.83       | 0.33               | 17.90 |
| 1996                                    | 11.91          | 64.6%      | 0.81        | 0.40       | 4.96       | 0.36               | 18.44 |
| 1997                                    | 12.05          | 65.2%      | 0.78        | 0.38       | 4.86       | 0.41               | 18.47 |
| 1998                                    | 12.36          | 65.5%      | 0.72        | 0.36       | 4.84       | 0.58               | 18.86 |
| 1999                                    | 12.70          | 65.3%      | 0.82        | 0.37       | 5.03       | 0.53               | 19.46 |
| 2000                                    | 12.98          | 65.9%      | 0.87        | 0.42       | 4.92       | 0.51               | 19.68 |
| 2001                                    | 12.86          | 65.7%      | 0.85        | 0.41       | 4.89       | 0.56               | 19.57 |
| 2002                                    | 13.12          | 66.7%      | 0.82        | 0.38       | 4.93       | 0.43               | 19.67 |
| 2003                                    | 13.20          | 66.3%      | 0.85        | 0.43       | 4.90       | 0.53               | 19.91 |
| 2004                                    | 13.61          | 65.9%      | 0.84        | 0.42       | 5.23       | 0.54               | 20.63 |
| 2005                                    | 13.79          | 66.8%      | 0.81        | 0.39       | 5.10       | 0.55               | 20.63 |
| 2006                                    | 13.95          | 68.2%      | 0.69        | 0.34       | 5.19       | 0.29               | 20.45 |
| 2007                                    | 14.00          | 68.7%      | 0.71        | 0.34       | 5.05       | 0.29               | 20.38 |
| 2008                                    | 13.33          | 69.7%      | 0.72        | 0.34       | 4.53       | 0.21               | 19.14 |
| 2009                                    | 12.82          | 70.0%      | 0.69        | 0.35       | 4.27       | 0.18               | 18.31 |
| 2010                                    | 12.96          | 69.7%      | 0.71        | 0.37       | 4.38       | 0.17               | 18.59 |
| <i>Average annual percentage change</i> |                |            |             |            |            |                    |       |
| 1973–2010                               | 1.0%           |            | -1.9%       | -2.0%      | -0.1%      | -5.8%              | 0.2%  |
| 2000–2010                               | 0.0%           |            | -2.0%       | -1.3%      | -1.2%      | -10.4%             | -0.6% |

**Source:**

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2011, Tables 2.2–2.6. Converted to million barrels per day using Table A3. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))



*Due to changes in the FHWA fuel use methodology, motorcycle, bus, and heavy truck data are not comparable with data before the year 2007. Light trucks include pick-ups, minivans, sport-utility vehicles, and vans. See Table 2.7 for highway energy use in trillion Btu.*

**Table 1.13**  
**Highway Transportation Petroleum Consumption by Mode, 1970–2009<sup>a</sup>**  
**(thousand barrels per day)**

| Year                                    | Autos | Light trucks | Light vehicles subtotal | Motor-cycles | Buses | Heavy trucks | Highway subtotal | Total transportation <sup>b</sup> |
|---|-------|--------------|-------------------------|--------------|-------|--------------|------------------|-----------------------------------|
| 1970                                    | 4,424 | 803          | 5,227                   | 4            | 62    | 738          | 6,031            | 7,333                             |
| 1975                                    | 4,836 | 1,245        | 6,081                   | 7            | 58    | 952          | 7,099            | 8,472                             |
| 1976                                    | 5,107 | 1,359        | 6,466                   | 8            | 63    | 1,005        | 7,542            | 8,969                             |
| 1977                                    | 5,157 | 1,460        | 6,617                   | 8            | 65    | 1,114        | 7,805            | 9,314                             |
| 1978                                    | 5,261 | 1,576        | 6,837                   | 9            | 66    | 1,247        | 8,160            | 9,793                             |
| 1979                                    | 4,996 | 1,595        | 6,591                   | 11           | 68    | 1,299        | 7,969            | 9,725                             |
| 1980                                    | 4,565 | 1,552        | 6,117                   | 13           | 68    | 1,302        | 7,500            | 9,118                             |
| 1981                                    | 4,508 | 1,546        | 6,054                   | 14           | 69    | 1,329        | 7,466            | 9,175                             |
| 1982                                    | 4,509 | 1,481        | 5,989                   | 13           | 71    | 1,330        | 7,403            | 8,944                             |
| 1983                                    | 4,587 | 1,562        | 6,149                   | 11           | 72    | 1,354        | 7,586            | 9,077                             |
| 1984                                    | 4,609 | 1,670        | 6,280                   | 11           | 69    | 1,398        | 7,758            | 9,364                             |
| 1985                                    | 4,665 | 1,785        | 6,450                   | 12           | 72    | 1,396        | 7,930            | 9,536                             |
| 1986                                    | 4,773 | 1,897        | 6,670                   | 12           | 76    | 1,426        | 8,184            | 9,896                             |
| 1987                                    | 4,782 | 1,996        | 6,778                   | 12           | 77    | 1,469        | 8,336            | 10,111                            |
| 1988                                    | 4,784 | 2,130        | 6,914                   | 13           | 80    | 1,495        | 8,503            | 10,343                            |
| 1989                                    | 4,821 | 2,170        | 6,992                   | 14           | 79    | 1,534        | 8,618            | 10,505                            |
| 1990                                    | 4,538 | 2,323        | 6,861                   | 12           | 78    | 1,597        | 8,549            | 10,440                            |
| 1991                                    | 4,196 | 2,493        | 6,688                   | 12           | 83    | 1,630        | 8,413            | 10,257                            |
| 1992                                    | 4,268 | 2,670        | 6,938                   | 12           | 87    | 1,660        | 8,698            | 10,595                            |
| 1993                                    | 4,374 | 2,795        | 7,169                   | 13           | 86    | 1,711        | 8,979            | 10,820                            |
| 1994                                    | 4,428 | 2,878        | 7,305                   | 13           | 86    | 1,806        | 9,211            | 11,089                            |
| 1995                                    | 4,440 | 2,975        | 7,415                   | 13           | 87    | 1,881        | 9,396            | 11,346                            |
| 1996                                    | 4,515 | 3,089        | 7,604                   | 13           | 88    | 1,931        | 9,636            | 11,601                            |
| 1997                                    | 4,559 | 3,222        | 7,781                   | 13           | 91    | 1,949        | 9,834            | 11,776                            |
| 1998                                    | 4,677 | 3,292        | 7,969                   | 13           | 93    | 2,012        | 10,086           | 12,060                            |
| 1999                                    | 4,780 | 3,448        | 8,228                   | 14           | 96    | 2,212        | 10,550           | 12,639                            |
| 2000                                    | 4,766 | 3,453        | 8,219                   | 14           | 98    | 2,298        | 11,073           | 13,235                            |
| 2001                                    | 4,798 | 3,491        | 8,290                   | 13           | 93    | 2,295        | 11,199           | 13,181                            |
| 2002                                    | 4,923 | 3,602        | 8,525                   | 12           | 91    | 2,401        | 11,457           | 13,366                            |
| 2003                                    | 4,866 | 3,963        | 8,829                   | 12           | 90    | 2,334        | 11,857           | 13,699                            |
| 2004                                    | 4,919 | 4,137        | 9,055                   | 13           | 92    | 2,162        | 12,070           | 14,090                            |
| 2005                                    | 5,050 | 3,840        | 8,890                   | 12           | 93    | 2,426        | 11,905           | 14,020                            |
| 2006                                    | 4,893 | 3,959        | 8,852                   | 14           | 94    | 2,476        | 12,003           | 14,171                            |
| 2007                                    | 4,852 | 4,034        | 8,885                   | 31           | 145   | 3,080        | 12,092           | 14,298                            |
| 2008                                    | 4,664 | 3,992        | 8,656                   | 32           | 148   | 3,112        | 11,898           | 13,886                            |
| 2009                                    | 4,662 | 4,019        | 8,681                   | 31           | 144   | 2,901        | 11,708           | 11,708                            |
| <i>Average annual percentage change</i> |       |              |                         |              |       |              |                  |                                   |
| 1970–2009                               | 0.1%  | 4.2%         | 1.3%                    | 5.4%         | 2.2%  | 3.6%         | 1.6%             | 1.1%                              |
| 1999–2009                               | -0.2% | 1.5%         | 0.5%                    | 8.3%         | 4.1%  | 2.7%         | 1.0%             | -0.8%                             |

**Source:**

See Appendix A for Highway Energy Use.

<sup>a</sup> Each gallon of petroleum product was assumed to equal one gallon of crude oil. The oil used to produce electricity is also estimated. See Appendix A, p. 18 for details.

<sup>b</sup> Total transportation figures do not include military and off-highway energy use and may not include all possible uses of fuel for transportation (e.g., snowmobiles).





*Although about 18% of transportation energy use is for nonhighway modes, only 14% of transportation petroleum use is for nonhighway. This is because some nonhighway modes, such as pipelines and transit rail, use electricity. An estimate for the petroleum used to make electricity is included in the data. See Table 2.8 for nonhighway transportation energy use in trillion Btu.*

**Table 1.14**  
**Nonhighway Transportation Petroleum Consumption by Mode, 1970–2009<sup>a</sup>**  
 (thousand barrels per day)

| Year                                    | Air   | Water | Pipeline | Rail  | Nonhighway<br>subtotal | Total<br>transportation <sup>b</sup> |
|---|-------|-------|----------|-------|------------------------|--------------------------------------|
| 1970                                    | 625   | 381   | 43       | 253   | 1,302                  | 7,333                                |
| 1975                                    | 651   | 423   | 50       | 249   | 1,373                  | 8,472                                |
| 1980                                    | 697   | 625   | 35       | 262   | 1,618                  | 9,118                                |
| 1981                                    | 706   | 722   | 29       | 253   | 1,709                  | 9,175                                |
| 1982                                    | 701   | 604   | 21       | 214   | 1,541                  | 8,944                                |
| 1983                                    | 699   | 561   | 20       | 212   | 1,491                  | 9,077                                |
| 1984                                    | 781   | 577   | 16       | 232   | 1,606                  | 9,364                                |
| 1985                                    | 814   | 564   | 13       | 216   | 1,606                  | 9,537                                |
| 1986                                    | 884   | 601   | 17       | 210   | 1,712                  | 9,896                                |
| 1987                                    | 920   | 626   | 15       | 213   | 1,775                  | 10,111                               |
| 1988                                    | 958   | 644   | 18       | 220   | 1,840                  | 10,343                               |
| 1989                                    | 960   | 688   | 18       | 221   | 1,887                  | 10,505                               |
| 1990                                    | 1,006 | 655   | 14       | 216   | 1,891                  | 10,440                               |
| 1991                                    | 940   | 690   | 12       | 202   | 1,845                  | 10,257                               |
| 1992                                    | 954   | 724   | 10       | 208   | 1,897                  | 10,595                               |
| 1993                                    | 961   | 653   | 11       | 215   | 1,841                  | 10,820                               |
| 1994                                    | 1,002 | 635   | 11       | 230   | 1,878                  | 11,089                               |
| 1995                                    | 1,036 | 668   | 7        | 239   | 1,950                  | 11,346                               |
| 1996                                    | 1,068 | 644   | 8        | 245   | 1,965                  | 11,601                               |
| 1997                                    | 1,114 | 574   | 9        | 246   | 1,942                  | 11,776                               |
| 1998                                    | 1,148 | 566   | 12       | 248   | 1,974                  | 12,060                               |
| 1999                                    | 1,196 | 625   | 11       | 257   | 2,089                  | 12,639                               |
| 2000                                    | 1,234 | 662   | 10       | 256   | 2,162                  | 12,791                               |
| 2001                                    | 1,167 | 546   | 11       | 257   | 1,982                  | 12,671                               |
| 2002                                    | 1,071 | 572   | 8        | 257   | 1,909                  | 12,938                               |
| 2003                                    | 1,073 | 496   | 10       | 263   | 1,843                  | 13,108                               |
| 2004                                    | 1,136 | 596   | 10       | 278   | 2,021                  | 13,343                               |
| 2005                                    | 1,199 | 625   | 10       | 281   | 2,115                  | 13,536                               |
| 2006                                    | 1,216 | 661   | 5        | 286   | 2,168                  | 13,604                               |
| 2007                                    | 1,215 | 709   | 5        | 277   | 2,206                  | 14,347                               |
| 2008                                    | 1,159 | 621   | 4        | 265   | 2,049                  | 13,997                               |
| 2009                                    | 1,035 | 589   | 3        | 220   | 1,847                  | 13,607                               |
| <i>Average annual percentage change</i> |       |       |          |       |                        |                                      |
| 1970–2009                               | 1.3%  | 1.1%  | -6.6%    | -0.4% | 0.9%                   | 1.6%                                 |
| 1999–2009                               | -1.4% | -0.6% | -12.2%   | -1.5% | -1.2%                  | 0.7%                                 |

**Source:**

See Appendix A for Nonhighway Energy Use.

<sup>a</sup> Each gallon of petroleum product was assumed to equal one gallon of crude oil. The oil used to produce electricity is also estimated. See Appendix A, p. 18 for details.

<sup>b</sup> Total transportation figures do not include military and off-highway energy use and may not include all possible uses of fuel for transportation (e.g., snowmobiles).





*Highway vehicles were responsible for over 86% of all transportation petroleum use in 2009. See Table 2.7 for transportation energy use in trillion Btu.*

**Table 1.15**  
**Transportation Petroleum Use by Mode, 2008–2009<sup>a</sup>**

|   | Thousand barrels per day |                 | Percentage of total |               |
|---|--------------------------|-----------------|---------------------|---------------|
|   | 2008                     | 2009            | 2008                | 2009          |
| <b>HIGHWAY</b>                            | <b>11,897.9</b>          | <b>11,708.1</b> | <b>85.3%</b>        | <b>86.4%</b>  |
| <b>Light vehicles</b>                     | <b>8,687.9</b>           | <b>8,712.2</b>  | <b>62.3%</b>        | <b>64.3%</b>  |
| Cars                                      | 4,663.9                  | 4,662.3         | 33.4%               | 34.4%         |
| Light trucks <sup>b</sup>                 | 3,992.1                  | 4,018.9         | 28.6%               | 29.6%         |
| Motorcycles                               | 31.9                     | 31.0            | 0.2%                | 0.2%          |
| <b>Buses</b>                              | <b>98.1</b>              | <b>95.0</b>     | <b>0.7%</b>         | <b>0.7%</b>   |
| Transit                                   | 45.2                     | 43.7            | 0.3%                | 0.3%          |
| Intercity                                 | 15.2                     | 14.7            | 0.1%                | 0.1%          |
| School                                    | 37.7                     | 36.5            | 0.3%                | 0.3%          |
| <b>Medium/heavy trucks</b>                | <b>3,111.9</b>           | <b>2,901.0</b>  | <b>22.3%</b>        | <b>21.4%</b>  |
| <b>NONHIGHWAY</b>                         | <b>2,049.2</b>           | <b>1,847.2</b>  | <b>14.7%</b>        | <b>13.6%</b>  |
| <b>Air</b>                                | <b>1,158.6</b>           | <b>1,035.1</b>  | <b>8.3%</b>         | <b>7.6%</b>   |
| General aviation                          | 130.5                    | 108.8           | 0.9%                | 0.8%          |
| Domestic air carriers                     | 826.3                    | 739.7           | 5.9%                | 5.5%          |
| International air                         | 201.8                    | 186.6           | 1.4%                | 1.4%          |
| <b>Water</b>                              | <b>621.4</b>             | <b>588.5</b>    | <b>4.5%</b>         | <b>4.3%</b>   |
| Freight                                   | 495.5                    | 462.8           | 3.6%                | 3.4%          |
| Recreational                              | 125.8                    | 125.8           | 0.9%                | 0.9%          |
| <b>Pipeline</b>                           | <b>3.8</b>               | <b>3.3</b>      | <b>0.0%</b>         | <b>0.0%</b>   |
| <b>Rail</b>                               | <b>265.5</b>             | <b>220.3</b>    | <b>1.9%</b>         | <b>1.6%</b>   |
| Freight (Class I)                         | 255.1                    | 210.0           | 1.8%                | 1.5%          |
| Passenger                                 | 10.3                     | 10.2            | 0.1%                | 0.1%          |
| Transit                                   | 0.7                      | 0.0             | 0.0%                | 0.0%          |
| Commuter                                  | 5.4                      | 6.2             | 0.0%                | 0.0%          |
| Intercity                                 | 4.1                      | 4.0             | 0.0%                | 0.0%          |
| <b>HWY &amp; NONHWY TOTAL<sup>c</sup></b> | <b>13,947.1</b>          | <b>13,555.3</b> | <b>100.0%</b>       | <b>100.0%</b> |
| <b>Off-Highway</b>                        | <b>980.5</b>             | <b>999.5</b>    |                     |               |

**Source:**

See Appendix A for Energy Use Sources.

<sup>a</sup> Each gallon of petroleum product was assumed to equal one gallon of crude oil. The oil used to produce electricity is also estimated. See Appendix A, p. 18 for details.

<sup>b</sup> Two-axle, four-tire trucks.

<sup>c</sup> Civilian consumption only. Totals may not include all possible uses of fuels for transportation (e.g., snowmobiles).





## Chapter 2

### Energy

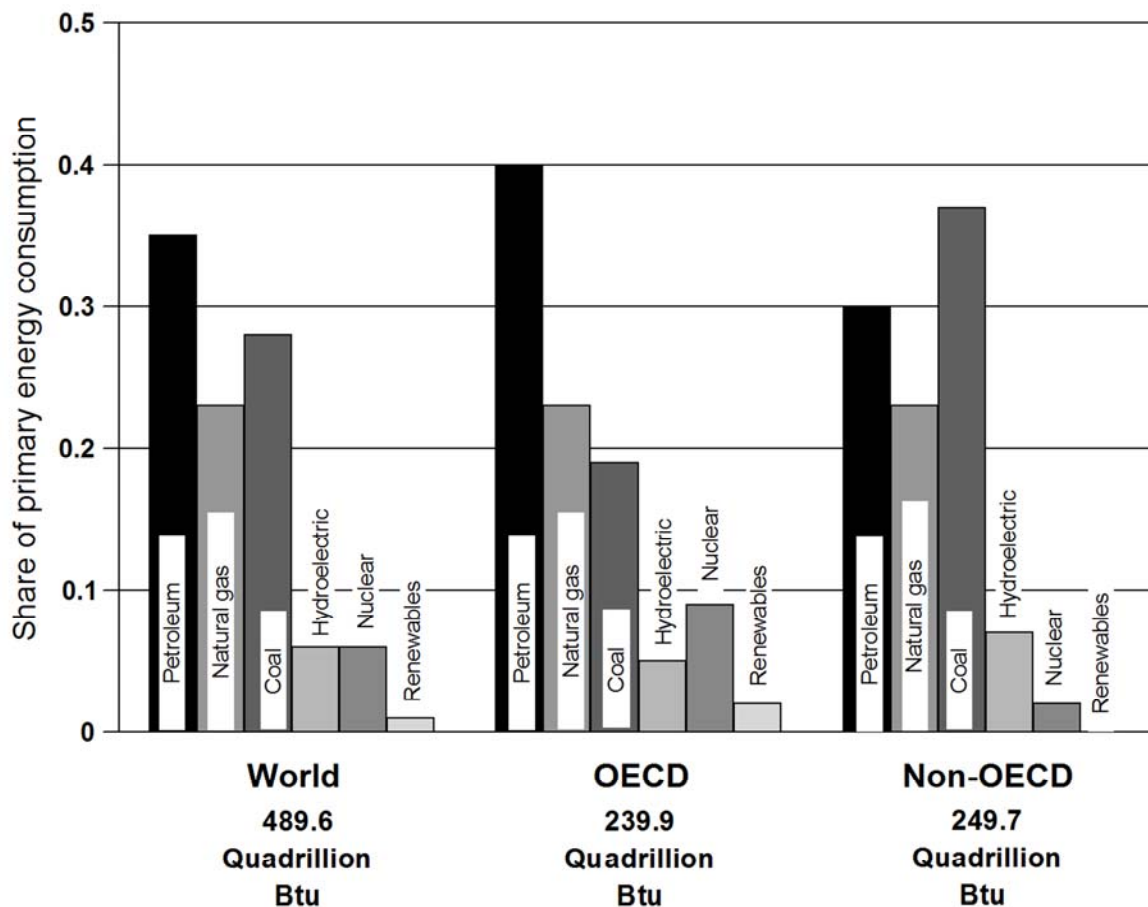
Summary Statistics from Tables in this Chapter

| Source    |  |  |                                      |
|-----------|--|--|--------------------------------------|
| Table 2.1 | Transportation share of U.S. energy consumption, 2010      |  | 28.1%                                |
| Table 2.2 | Petroleum share of transportation energy consumption, 2010 |  | 93.2%                                |
| Table 2.3 | Alternative fuel and oxygenate consumption, 2009           |  |                                      |
|           |  | (thousand gasoline equivalent gallons) | (share of Total alt fuel/oxygenates) |
|           | <i>Ethanol in gasohol</i>                                  | 7,343,133                              | 90.7%                                |
|           | <i>MTBE</i>  | 0                                      | 0.0%                                 |
|           | <i>Liquefied petroleum gas</i>                             | 129,631                                | 1.6%                                 |
|           | <i>Compressed natural gas</i>                              | 199,513                                | 2.5%                                 |
|           | <i>E85</i>   | 71,213                                 | 0.9%                                 |
|           | <i>Liquefied natural gas</i>                               | 26,652                                 | 0.3%                                 |
|           | <i>Electricity</i>   | 4,956                                  | 0.1%                                 |
| Table 2.6 | Transportation energy use by mode, 2009                    | (trillion Btu)                         | (share)                              |
|           | <i>Cars</i>  | 8,811                                  | 31.9%                                |
|           | <i>Light trucks</i>  | 7,608                                  | 27.6%                                |
|           | <i>Medium/heavy trucks</i>                                 | 6,084                                  | 22.1%                                |
|           | <i>Buses</i>   | 200                                    | 0.7%                                 |
|           | <i>Total Highway</i>                                       | 22,763                                 | 82.5%                                |
|           | <i>Air</i>   | 2,138                                  | 7.7%                                 |
|           | <i>Water</i>   | 1,291                                  | 4.7%                                 |
|           | <i>Pipeline</i>  | 857                                    | 3.1%                                 |
|           | <i>Rail</i>  | 540                                    | 2.0%                                 |



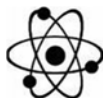
*Petroleum accounted for 35% of the world's energy use in 2008. Though petroleum is the dominant energy source for both OECD countries and non-OECD countries, the non-OECD countries rely on coal, natural gas, and hydroelectric power more than OECD countries do.*

**Figure 2.1. World Consumption of Primary Energy, 2008**



**Source:**

U.S. Department of Energy, Energy Information Administration, *International Energy Statistics Database*, May 2011. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))



Total energy use was 98.0 quads in 2010 with transportation using 28.1%. The Energy Information Administration includes renewable energy in each sector.

**Table 2.1**  
**U. S. Consumption of Total Energy by End-Use Sector, 1973–2010**  
**(quadrillion Btu)**

| Year                                    | Transportation | Percentage<br>transportation of<br>total | Industrial | Commercial | Residential | Total <sup>a</sup> |
|---|----------------|--|------------|------------|-------------|--------------------|
| 1973                                    | 18.6           | 24.6%                                    | 32.6       | 9.5        | 14.9        | 75.7               |
| 1974                                    | 18.1           | 24.5%                                    | 31.8       | 9.4        | 14.7        | 74.0               |
| 1975                                    | 18.2           | 25.3%                                    | 29.4       | 9.5        | 14.8        | 72.0               |
| 1976                                    | 19.1           | 25.1%                                    | 31.4       | 10.1       | 15.4        | 76.0               |
| 1977                                    | 19.8           | 25.4%                                    | 32.3       | 10.2       | 15.7        | 78.0               |
| 1978                                    | 20.6           | 25.8%                                    | 32.7       | 10.5       | 16.1        | 80.0               |
| 1979                                    | 20.5           | 25.3%                                    | 33.9       | 10.6       | 15.8        | 80.9               |
| 1980                                    | 19.7           | 25.2%                                    | 32.0       | 10.6       | 15.8        | 78.1               |
| 1981                                    | 19.5           | 25.6%                                    | 30.7       | 10.6       | 15.3        | 76.1               |
| 1982                                    | 19.1           | 26.1%                                    | 27.6       | 10.9       | 15.5        | 73.1               |
| 1983                                    | 19.2           | 26.3%                                    | 27.4       | 10.9       | 15.4        | 73.0               |
| 1984                                    | 19.7           | 25.7%                                    | 29.6       | 11.4       | 16.0        | 76.7               |
| 1985                                    | 20.1           | 26.3%                                    | 28.8       | 11.4       | 16.0        | 76.4               |
| 1986                                    | 20.8           | 27.1%                                    | 28.3       | 11.6       | 16.0        | 76.7               |
| 1987                                    | 21.5           | 27.2%                                    | 28.4       | 11.9       | 16.3        | 79.1               |
| 1988                                    | 22.3           | 27.0%                                    | 30.7       | 12.6       | 17.1        | 82.7               |
| 1989                                    | 22.5           | 26.5%                                    | 31.3       | 13.2       | 17.8        | 84.8               |
| 1990                                    | 22.4           | 26.5%                                    | 31.8       | 13.3       | 17.0        | 84.5               |
| 1991                                    | 22.1           | 26.2%                                    | 31.4       | 13.4       | 17.4        | 84.4               |
| 1992                                    | 22.4           | 26.1%                                    | 32.6       | 13.4       | 17.4        | 85.8               |
| 1993                                    | 22.8           | 26.1%                                    | 32.6       | 13.8       | 18.2        | 87.4               |
| 1994                                    | 23.4           | 26.3%                                    | 33.5       | 14.1       | 18.1        | 89.1               |
| 1995                                    | 23.8           | 26.2%                                    | 34.0       | 14.7       | 18.5        | 91.0               |
| 1996                                    | 24.4           | 26.0%                                    | 34.9       | 15.2       | 19.5        | 94.0               |
| 1997                                    | 24.7           | 26.2%                                    | 35.2       | 15.7       | 19.0        | 94.6               |
| 1998                                    | 25.3           | 26.8%                                    | 34.8       | 16.0       | 19.0        | 95.0               |
| 1999                                    | 25.9           | 26.8%                                    | 34.8       | 16.4       | 19.6        | 96.7               |
| 2000                                    | 26.5           | 26.9%                                    | 34.7       | 17.2       | 20.4        | 98.8               |
| 2001                                    | 26.3           | 27.3%                                    | 32.7       | 17.1       | 20.0        | 96.2               |
| 2002                                    | 26.8           | 27.5%                                    | 32.7       | 17.4       | 20.8        | 97.7               |
| 2003                                    | 27.0           | 27.5%                                    | 32.5       | 17.3       | 21.1        | 98.0               |
| 2004                                    | 27.9           | 27.9%                                    | 33.5       | 17.7       | 21.1        | 100.1              |
| 2005                                    | 28.4           | 28.3%                                    | 32.4       | 17.9       | 21.6        | 100.3              |
| 2006                                    | 28.8           | 28.9%                                    | 32.4       | 17.7       | 20.7        | 99.6               |
| 2007                                    | 29.1           | 28.7%                                    | 32.4       | 18.3       | 21.6        | 101.4              |
| 2008                                    | 28.0           | 28.2%                                    | 31.3       | 18.4       | 21.6        | 99.3               |
| 2009                                    | 27.0           | 28.6%                                    | 28.5       | 17.9       | 21.1        | 94.5               |
| 2010                                    | 27.5           | 28.1%                                    | 30.1       | 18.2       | 22.2        | 98.0               |
| <i>Average annual percentage change</i> |                |  |            |            |             |                    |
| 1973–2010                               | 1.1%           |  | -0.2%      | 1.8%       | 1.1%        | 0.7%               |
| 2000–2010                               | 0.4%           |  | -1.4%      | 0.6%       | 0.8%        | -0.1%              |

**Source:**

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, April 2011, Washington, DC, Table 2.1. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

<sup>a</sup> Electrical energy losses have been distributed among the sectors.



*In transportation, the alcohol fuels blended into gasoline to make gasohol (10% ethanol or less) are counted under “renewables” and are not in with petroleum. The petroleum category, however, still contains other blending agents, such as MTBE, that are not actually petroleum, but are not broken out into a separate category.*

**Table 2.2**  
**Distribution of Energy Consumption by Source, 1973 and 2010**  
**(percentage)**

| Energy source            | Transportation |        | Residential |        | Commercial |        |
|--------------------------|----------------|--------|-------------|--------|------------|--------|
|                          | 1973           | 2010   | 1973        | 2010   | 1973       | 2010   |
| Petroleum <sup>a</sup>   | 95.8           | 93.2   | 18.9        | 5.5    | 16.5       | 3.9    |
| Natural gas <sup>b</sup> | 4.0            | 2.5    | 33.3        | 22.8   | 27.9       | 18.0   |
| Coal                     | 0.0            | 0.0    | 0.6         | 0.0    | 1.7        | 0.3    |
| Renewable                | 0.0            | 4.0    | 2.4         | 2.5    | 0.1        | 0.7    |
| Nuclear                  | 0.0            | 0.0    | 0.0         | 0.0    | 0.0        | 0.0    |
| Electricity <sup>c</sup> | 0.2            | 0.3    | 44.7        | 69.1   | 53.9       | 77.1   |
| Total                    | 100.00         | 100.00 | 100.00      | 100.00 | 100.00     | 100.00 |

| Energy source            | Industrial |        | Electric utilities |        |
|--------------------------|------------|--------|--------------------|--------|
|                          | 1973       | 2010   | 1973               | 2010   |
| Petroleum <sup>a</sup>   | 27.9       | 26.6   | 17.8               | 1.0    |
| Natural gas <sup>b</sup> | 31.8       | 26.9   | 19.0               | 19.0   |
| Coal                     | 12.4       | 5.4    | 43.8               | 48.0   |
| Renewable                | 3.7        | 7.2    | 14.5               | 10.6   |
| Nuclear                  | 0.0        | 0.0    | 4.6                | 21.3   |
| Electricity <sup>c</sup> | 24.2       | 33.8   | 0.2                | 0.2    |
| Total                    | 100.00     | 100.00 | 100.00             | 100.00 |

**Source:**

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2011, Washington, DC, Tables 2.2, 2.3, 2.4, 2.5, and 2.6. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

**Note:** Numbers may not add due to rounding.

<sup>a</sup> In transportation, the petroleum category contains some blending agents which are not petroleum.

<sup>b</sup> Includes supplemental gaseous fuels. Transportation sector includes pipeline fuel and natural gas vehicle use.

<sup>c</sup> Includes electrical system energy losses.



*Oxygenates are blended with gasoline to be used in conventional vehicles. The amount of oxygenate use dwarfs the alternative fuel use. Gasoline-equivalent gallons are used in this table to allow comparisons of different fuel types.*

**Table 2.3**  
**Alternative Fuel and Oxygenate Consumption, 2003–2009**  
**(thousand gasoline-equivalent gallons)**

|                          | 2003             | 2004             | 2005             | 2006             | 2007             | 2008             | 2009             |
|--------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Alternative fuel         |                  |                  |                  |                  |                  |                  |                  |
| Liquefied petroleum gas  | 224,697          | 211,883          | 188,171          | 173,130          | 152,360          | 147,784          | 129,631          |
| Compressed natural gas   | 133,222          | 158,903          | 166,878          | 172,011          | 178,585          | 189,358          | 199,513          |
| Liquefied natural gas    | 13,503           | 20,888           | 22,409           | 23,474           | 24,594           | 25,554           | 25,652           |
| E85 <sup>a</sup>         | 26,376           | 31,581           | 38,074           | 44,041           | 54,091           | 62,464           | 71,213           |
| Electricity <sup>b</sup> | 5,141            | 5,269            | 5,219            | 5,104            | 5,037            | 5,050            | 4,956            |
| Hydrogen                 | 2                | 8                | 25               | 41               | 66               | 117              | 140              |
| Biodiesel                | 18,220           | 28,244           | 91,649           | 260,606          | 367,764          | 324,329          | 325,102          |
| Other                    | 0                | 0                | 2                | 2                | 2                | 2                | 2                |
| <b>Subtotal</b>          | <b>421,161</b>   | <b>456,766</b>   | <b>512,427</b>   | <b>678,409</b>   | <b>782,479</b>   | <b>754,658</b>   | <b>756,209</b>   |
| Oxygenates               |                  |                  |                  |                  |                  |                  |                  |
| MTBE <sup>c</sup>        | 2,368,400        | 1,877,300        | 1,654,500        | 435,000          | 0                | 0                | 0                |
| Ethanol in gasohol       | 1,919,572        | 2,414,167        | 2,756,663        | 3,729,168        | 4,694,304        | 6,442,781        | 7,343,133        |
| <b>Total</b>             | <b>4,709,133</b> | <b>4,748,243</b> | <b>4,923,590</b> | <b>4,842,577</b> | <b>5,476,783</b> | <b>7,197,439</b> | <b>8,099,342</b> |

**Source:**

U.S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels, 2009*, Washington, DC, April 2011, Web site  
[www.eia.doe.gov/renewable/alternative\\_transport\\_vehicles/index.cfm](http://www.eia.doe.gov/renewable/alternative_transport_vehicles/index.cfm). (Additional resources:  
[www.eia.doe.gov](http://www.eia.doe.gov))

<sup>a</sup> Consumption includes gasoline portion of the mixture.

<sup>b</sup> Vehicle consumption only; does not include power plant inputs.

<sup>c</sup> Methyl Tertiary Butyl Ether. This category includes a very small amount of other ethers, primarily Tertiary Amyl Methyl Ether (TAME) and Ethyl Tertiary Butyl Ether (ETBE).



*Ethanol is used as an oxygenate, blended with gasoline to be used as gasohol in conventional vehicles. The amount of ethanol used in gasohol dwarfs the amount used in E85. Production of E95 ended in 2000.*

**Table 2.4**  
**Ethanol Consumption, 1995–2009**  
(thousand gallons)

|                 | Ethanol blends |      | Ethanol in gasohol | Total     |
|-----------------|----------------|------|--------------------|-----------|
|                 | E85            | E95  |                    |           |
| 1995            | 166            | 970  | 934,615            | 935,751   |
| 2000            | 10,530         | 12   | 1,114,313          | 1,124,855 |
| 2001            | 12,756         | 0    | 1,173,323          | 1,186,079 |
| 2002            | 15,513         | 0    | 1,450,721          | 1,466,234 |
| 2003            | 26,376         | 0    | 1,919,572          | 1,945,948 |
| 2004            | 31,581         | 0    | 2,414,167          | 2,445,748 |
| 2005            | 38,074         | 0    | 2,756,663          | 2,794,737 |
| 2006            | 44,041         | 0    | 3,729,168          | 3,773,209 |
| 2007            | 54,091         | 0    | 4,694,304          | 4,748,395 |
| 2008            | 62,464         | 0    | 6,442,781          | 6,505,245 |
| 2009            | 71,213         | 0    | 7,343,133          | 7,414,346 |
| 2009 Percentage | 1.0%           | 0.0% | 99.0%              | 100.0%    |

**Source:**

U.S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels, 2009*, Washington, DC, April 2011, Web site:  
[http://www.eia.doe.gov/renewable/alternative\\_transport\\_vehicles/index.cfm](http://www.eia.doe.gov/renewable/alternative_transport_vehicles/index.cfm), Table C1. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

**Note:** Gallons of E85, E95 and Ethanol in gasohol, do not include the gasoline portion of the blended fuel.





*As data about alternative fuel use become available, an attempt is made to incorporate them into this table. Sometimes assumptions must be made in order to use the data. Please see Appendix A for a description of the methodology used to develop these data. See Table 1.15 for transportation petroleum use in thousand barrels per day.*

**Table 2.5**  
**Domestic Consumption of Transportation Energy by Mode and Fuel Type, 2009<sup>a</sup>**  
(trillion Btu)

|   | Gasoline        | Diesel<br>fuel | Liquefied<br>petroleum<br>gas | Jet fuel       | Residual<br>fuel oil | Natural<br>gas | Electricity  | Total           |
|---|-----------------|----------------|-------------------------------|----------------|----------------------|----------------|--------------|-----------------|
| <b><u>HIGHWAY</u></b>                   | <b>16,661.4</b> | <b>6,013.6</b> | <b>65.3</b>                   |                |                      | <b>22.0</b>    | <b>0.7</b>   | <b>22,763.0</b> |
| <b>Light vehicles</b>                   | <b>16,042.1</b> | <b>391.4</b>   | <b>45.0</b>                   |                |                      | <b>0.0</b>     | <b>0.0</b>   | <b>16,478.5</b> |
| Cars                                    | 8,761.4         | 49.6           |                               |                |                      |                |              | 8,811.0         |
| Light trucks <sup>b</sup>               | 7,221.3         | 341.8          | 45.0                          |                |                      |                |              | 7,608.1         |
| Motorcycles                             | 59.4            |                |                               |                |                      |                |              | 59.4            |
| <b>Buses</b>                            | <b>7.8</b>      | <b>169.5</b>   | <b>0.0</b>                    |                |                      | <b>22.0</b>    | <b>0.7</b>   | <b>200.0</b>    |
| Transit                                 | 0.8             | 68.3           | 0.0                           |                |                      | 22.0           | 0.7          | 91.8            |
| Intercity                               |                 | 31.4           |                               |                |                      |                |              | 31.4            |
| School                                  | 7.0             | 69.9           |                               |                |                      |                |              | 76.9            |
| <b>Medium/heavy trucks</b>              | <b>611.5</b>    | <b>5,452.7</b> | <b>20.3</b>                   |                |                      |                |              | <b>6,084.5</b>  |
| <b><u>NONHIGHWAY</u></b>                | <b>237.1</b>    | <b>721.4</b>   | <b>0.0</b>                    | <b>2,099.3</b> | <b>839.4</b>         | <b>616.8</b>   | <b>312.2</b> | <b>4,826.1</b>  |
| <b>Air</b>                              | <b>38.2</b>     | <b>0.0</b>     | <b>0.0</b>                    | <b>2,099.3</b> | <b>0.0</b>           | <b>0.0</b>     | <b>0.0</b>   | <b>2,137.5</b>  |
| General aviation                        | 38.2            |                |                               | 182.3          |                      |                |              | 220.6           |
| Domestic air carriers                   |                 |                |                               | 1,530.8        |                      |                |              | 1,530.8         |
| International air carriers <sup>c</sup> |                 |                |                               | 386.2          |                      |                |              | 386.2           |
| <b>Water</b>                            | <b>198.8</b>    | <b>253.0</b>   |                               |                | <b>839.4</b>         |                |              | <b>1,291.3</b>  |
| Freight                                 |                 | 206.2          |                               |                | 839.4                |                |              | 1,045.6         |
| Recreational                            | 198.8           | 46.8           |                               |                |                      |                |              | 245.6           |
| <b>Pipeline</b>                         | <b>0.0</b>      | <b>0.0</b>     | <b>0.0</b>                    | <b>0.0</b>     | <b>0.0</b>           | <b>616.8</b>   | <b>240.1</b> | <b>856.9</b>    |
| <b>Rail</b>                             | <b>0.0</b>      | <b>468.4</b>   | <b>0.0</b>                    | <b>0.0</b>     | <b>0.0</b>           | <b>0.0</b>     | <b>72.1</b>  | <b>540.4</b>    |
| Freight (Class I)                       |                 | 446.6          |                               |                |                      |                |              | 446.6           |
| Passenger                               |                 | 21.7           |                               |                |                      |                | 72.1         | 93.8            |
| Transit                                 |                 | 0.0            |                               |                |                      |                | 47.8         | 47.8            |
| Commuter                                |                 | 13.2           |                               |                |                      |                | 18.4         | 31.6            |
| Intercity                               |                 | 8.6            |                               |                |                      |                | 5.8          | 14.4            |
| <b>TOTAL HWY &amp;<br/>NONHWY</b>       | <b>16,898.5</b> | <b>6,735.0</b> | <b>65.3</b>                   | <b>2,099.3</b> | <b>839.4</b>         | <b>638.7</b>   | <b>312.9</b> | <b>27,589.0</b> |

**Source:**

See Appendix A for Energy Use Sources.

<sup>a</sup> Civilian consumption only. Totals may not include all possible uses of fuels for transportation (e.g., snowmobiles).

<sup>b</sup> Two-axle, four-tire trucks.

<sup>c</sup> One half of fuel used by domestic carriers in international operation.



*Highway vehicles were responsible for 82.5% of all transportation energy use in 2009. See Table 1.15 for transportation energy use in thousand barrels per day.*

**Table 2.6**  
**Transportation Energy Use by Mode, 2008–2009<sup>a</sup>**

|                               | Trillion Btu    |                 | Percentage of total based on Btus |               |
|-------------------------------|-----------------|-----------------|-----------------------------------|---------------|
|                               | 2008            | 2009            | 2008                              | 2009          |
| <b><u>HIGHWAY</u></b>         | <b>21,657.1</b> | <b>22,763.0</b> | <b>80.7%</b>                      | <b>82.5%</b>  |
| <b>Light vehicles</b>         | <b>16,435.7</b> | <b>16,478.5</b> | <b>61.3%</b>                      | <b>59.7%</b>  |
| Cars                          | 8,831.4         | 8,811.0         | 32.9%                             | 31.9%         |
| Light trucks <sup>b</sup>     | 7,572.2         | 7,608.1         | 28.2%                             | 27.6%         |
| Motorcycles                   | 32.0            | 59.4            | 0.1%                              | 0.2%          |
| <b>Buses</b>                  | <b>199.8</b>    | <b>200.0</b>    | <b>0.7%</b>                       | <b>0.7%</b>   |
| Transit                       | 95.3            | 91.8            | 0.4%                              | 0.3%          |
| Intercity                     | 30.3            | 31.4            | 0.1%                              | 0.1%          |
| School                        | 74.3            | 76.9            | 0.3%                              | 0.3%          |
| <b>Medium/heavy trucks</b>    | <b>5,021.6</b>  | <b>6,084.5</b>  | <b>18.7%</b>                      | <b>22.1%</b>  |
| <b><u>NONHIGHWAY</u></b>      | <b>5,165.4</b>  | <b>4,826.1</b>  | <b>19.3%</b>                      | <b>17.5%</b>  |
| <b>Air</b>                    | <b>2,393.3</b>  | <b>2,137.5</b>  | <b>8.9%</b>                       | <b>7.7%</b>   |
| General aviation              | 265.7           | 220.6           | 1.0%                              | 0.8%          |
| Domestic air carriers         | 1,710.0         | 1,530.8         | 6.4%                              | 5.5%          |
| International air             | 417.6           | 386.2           | 1.6%                              | 1.4%          |
| <b>Water</b>                  | <b>1,227.2</b>  | <b>1,291.3</b>  | <b>4.6%</b>                       | <b>4.7%</b>   |
| Freight                       | 981.6           | 1,045.6         | 3.7%                              | 3.8%          |
| Recreational                  | 245.7           | 245.6           | 0.9%                              | 0.9%          |
| <b>Pipeline</b>               | <b>910.5</b>    | <b>856.9</b>    | <b>3.4%</b>                       | <b>3.1%</b>   |
| <b>Rail</b>                   | <b>634.4</b>    | <b>540.4</b>    | <b>2.4%</b>                       | <b>2.0%</b>   |
| Freight (Class I)             | 542.5           | 446.6           | 2.0%                              | 1.6%          |
| Passenger                     | 91.9            | 93.8            | 0.3%                              | 0.3%          |
| Transit                       | 47.8            | 47.8            | 0.2%                              | 0.2%          |
| Commuter                      | 29.3            | 31.6            | 0.1%                              | 0.1%          |
| Intercity                     | 14.8            | 14.4            | 0.1%                              | 0.1%          |
| <b>HWY &amp; NONHWY TOTAL</b> | <b>26,822.6</b> | <b>27,589.0</b> | <b>100.0%</b>                     | <b>100.0%</b> |
| <b>Off-Highway</b>            | <b>1,957.9</b>  | <b>1,997.5</b>  |                                   |               |

**Source:**

See Appendix A for Energy Use Sources.

<sup>a</sup> Civilian consumption only. Totals may not include all possible uses of fuels for transportation (e.g., snowmobiles).

<sup>b</sup> Two-axle, four-tire trucks.



*Due to changes in the FHWA fuel use methodology, motorcycle, bus, and heavy truck data are not comparable with data before the year 2007. Light trucks include pick-ups, minivans, sport-utility vehicles, and vans. See Table 1.13 for highway petroleum use in thousand barrels per day.*

**Table 2.7**  
**Highway Transportation Energy Consumption by Mode, 1970–2009**  
(trillion Btu)

| Year                                    | Autos | Light trucks | Light vehicles subtotal | Motor-cycles | Buses | Heavy trucks | Highway subtotal | Total transportation <sup>a</sup> |
|---|-------|--------------|-------------------------|--------------|-------|--------------|------------------|-----------------------------------|
| 1970                                    | 8,479 | 1,539        | 10,018                  | 7            | 129   | 1,553        | 11,707           | 15,395                            |
| 1975                                    | 9,298 | 2,384        | 11,682                  | 14           | 124   | 2,003        | 13,823           | 17,424                            |
| 1980                                    | 8,800 | 2,975        | 11,775                  | 26           | 143   | 2,686        | 14,630           | 18,940                            |
| 1981                                    | 8,693 | 2,963        | 11,656                  | 27           | 145   | 2,724        | 14,552           | 18,741                            |
| 1982                                    | 8,673 | 2,837        | 11,510                  | 25           | 151   | 2,707        | 14,393           | 18,237                            |
| 1983                                    | 8,802 | 2,990        | 11,792                  | 22           | 152   | 2,770        | 14,736           | 18,368                            |
| 1984                                    | 8,837 | 3,197        | 12,034                  | 22           | 146   | 2,873        | 15,075           | 18,962                            |
| 1985                                    | 8,932 | 3,413        | 12,345                  | 23           | 153   | 2,883        | 15,404           | 19,205                            |
| 1986                                    | 9,138 | 3,629        | 12,767                  | 23           | 160   | 2,958        | 15,908           | 20,276                            |
| 1987                                    | 9,157 | 3,819        | 12,976                  | 24           | 164   | 3,061        | 16,225           | 20,771                            |
| 1988                                    | 9,158 | 4,078        | 13,236                  | 25           | 169   | 3,118        | 16,548           | 21,327                            |
| 1989                                    | 9,232 | 4,156        | 13,388                  | 26           | 169   | 3,199        | 16,782           | 21,685                            |
| 1990                                    | 8,688 | 4,451        | 13,139                  | 24           | 167   | 3,334        | 16,664           | 21,613                            |
| 1991                                    | 8,029 | 4,774        | 12,803                  | 23           | 177   | 3,402        | 16,405           | 21,205                            |
| 1992                                    | 8,169 | 5,117        | 13,286                  | 24           | 184   | 3,468        | 16,962           | 21,866                            |
| 1993                                    | 8,368 | 5,356        | 13,724                  | 25           | 183   | 3,577        | 17,509           | 22,322                            |
| 1994                                    | 8,470 | 5,515        | 13,985                  | 26           | 183   | 3,778        | 17,972           | 22,926                            |
| 1995                                    | 8,489 | 5,695        | 14,184                  | 25           | 184   | 3,937        | 18,330           | 23,465                            |
| 1996                                    | 8,634 | 5,917        | 14,551                  | 24           | 186   | 4,045        | 18,806           | 23,973                            |
| 1997                                    | 8,710 | 6,168        | 14,878                  | 25           | 192   | 4,086        | 19,181           | 24,327                            |
| 1998                                    | 8,936 | 6,304        | 15,240                  | 26           | 196   | 4,218        | 19,680           | 24,757                            |
| 1999                                    | 9,134 | 6,602        | 15,736                  | 26           | 203   | 4,638        | 20,603           | 25,948                            |
| 2000                                    | 9,100 | 6,607        | 15,707                  | 26           | 209   | 4,819        | 20,761           | 26,268                            |
| 2001                                    | 9,161 | 6,678        | 15,839                  | 24           | 196   | 4,813        | 20,872           | 25,958                            |
| 2002                                    | 9,391 | 6,883        | 16,274                  | 24           | 192   | 5,035        | 21,525           | 26,521                            |
| 2003                                    | 9,255 | 7,551        | 16,806                  | 24           | 190   | 4,895        | 21,915           | 26,672                            |
| 2004                                    | 9,331 | 7,861        | 17,192                  | 25           | 194   | 4,535        | 21,946           | 27,065                            |
| 2005                                    | 9,579 | 7,296        | 16,875                  | 24           | 196   | 5,088        | 22,183           | 27,526                            |
| 2006                                    | 9,316 | 7,550        | 16,866                  | 28           | 199   | 5,193        | 22,286           | 27,759                            |
| 2007                                    | 9,221 | 7,679        | 16,900                  | 59           | 306   | 6,460        | 23,726           | 29,334                            |
| 2008                                    | 8,831 | 7,572        | 16,404                  | 61           | 313   | 6,527        | 23,305           | 28,611                            |
| 2009                                    | 8,811 | 7,608        | 16,419                  | 59           | 303   | 6,085        | 22,866           | 27,692                            |
| <i>Average annual percentage change</i> |       |              |                         |              |       |              |                  |                                   |
| 1970–2009                               | 0.1%  | 4.2%         | 1.3%                    | 5.6%         | 2.2%  | 3.6%         | 1.7%             | 1.5%                              |
| 2000–2009                               | -0.4% | 1.6%         | 0.5%                    | 6.7%         | 4.1%  | 0.6%         | 1.0%             | 0.7%                              |

**Source:**

See Appendix A for Highway Energy Use.

**Note:** Totals may not add due to rounding.

<sup>a</sup> Total transportation figures do not include military and off-highway energy use and may not include all possible uses of fuel for transportation (e.g., snowmobiles). These data have been revised due to a new data series for recreational boats.



About **18%** of transportation energy use is for nonhighway modes. Air travel accounts for over 44% of nonhighway energy use. See Table 1.14 for nonhighway petroleum use in thousand barrels per day.

**Table 2.8**  
**Nonhighway Transportation Energy Consumption by Mode, 1970–2009**  
(trillion Btu)

| Year                                    | Air   | Water | Pipeline | Rail  | Nonhighway subtotal | Total transportation <sup>a</sup> |
|---|-------|-------|----------|-------|---------------------|-----------------------------------|
| 1970                                    | 1,307 | 836   | 990      | 555   | 3,688               | 15,395                            |
| 1975                                    | 1,274 | 927   | 840      | 559   | 3,601               | 17,424                            |
| 1976                                    | 1,333 | 1,083 | 803      | 581   | 3,800               | 18,491                            |
| 1977                                    | 1,350 | 1,177 | 786      | 591   | 3,904               | 19,126                            |
| 1978                                    | 1,423 | 1,382 | 784      | 588   | 4,177               | 20,097                            |
| 1979                                    | 1,488 | 1,149 | 860      | 607   | 4,104               | 19,652                            |
| 1980                                    | 1,434 | 1,393 | 896      | 588   | 4,310               | 18,940                            |
| 1981                                    | 1,453 | 1,270 | 904      | 561   | 4,189               | 18,741                            |
| 1982                                    | 1,445 | 1,063 | 855      | 481   | 3,844               | 18,237                            |
| 1983                                    | 1,440 | 974   | 740      | 478   | 3,632               | 18,368                            |
| 1984                                    | 1,609 | 964   | 782      | 532   | 3,887               | 18,962                            |
| 1985                                    | 1,677 | 871   | 755      | 498   | 3,801               | 19,205                            |
| 1986                                    | 1,823 | 1,323 | 735      | 487   | 4,368               | 20,276                            |
| 1987                                    | 1,899 | 1,378 | 772      | 498   | 4,546               | 20,771                            |
| 1988                                    | 1,978 | 1,417 | 874      | 511   | 4,779               | 21,327                            |
| 1989                                    | 1,981 | 1,516 | 890      | 515   | 4,903               | 21,685                            |
| 1990                                    | 2,077 | 1,442 | 923      | 506   | 4,949               | 21,613                            |
| 1991                                    | 1,939 | 1,523 | 860      | 478   | 4,800               | 21,205                            |
| 1992                                    | 1,970 | 1,599 | 846      | 490   | 4,904               | 21,866                            |
| 1993                                    | 1,986 | 1,437 | 885      | 505   | 4,813               | 22,322                            |
| 1994                                    | 2,070 | 1,394 | 951      | 539   | 4,954               | 22,926                            |
| 1995                                    | 2,141 | 1,468 | 967      | 559   | 5,135               | 23,465                            |
| 1996                                    | 2,206 | 1,411 | 979      | 572   | 5,167               | 23,973                            |
| 1997                                    | 2,300 | 1,250 | 1,022    | 574   | 5,146               | 24,327                            |
| 1998                                    | 2,371 | 1,232 | 897      | 578   | 5,077               | 24,757                            |
| 1999                                    | 2,471 | 1,367 | 908      | 599   | 5,345               | 25,948                            |
| 2000                                    | 2,549 | 1,454 | 904      | 601   | 5,507               | 26,268                            |
| 2001                                    | 2,411 | 1,186 | 886      | 603   | 5,086               | 25,958                            |
| 2002                                    | 2,213 | 1,247 | 931      | 605   | 4,996               | 26,521                            |
| 2003                                    | 2,217 | 1,074 | 850      | 617   | 4,757               | 26,672                            |
| 2004                                    | 2,348 | 1,299 | 822      | 650   | 5,119               | 27,065                            |
| 2005                                    | 2,477 | 1,368 | 842      | 657   | 5,343               | 27,526                            |
| 2006                                    | 2,511 | 1,450 | 842      | 670   | 5,473               | 27,759                            |
| 2007                                    | 2,509 | 1,559 | 882      | 657   | 5,608               | 29,334                            |
| 2008                                    | 2,393 | 1,368 | 911      | 634   | 5,306               | 28,611                            |
| 2009                                    | 2,138 | 1,291 | 857      | 540   | 4,826               | 27,692                            |
| <i>Average annual percentage change</i> |       |       |          |       |                     |                                   |
| 1970–2009                               | 1.3%  | 1.1%  | -0.4%    | -0.1% | 0.7%                | 1.5%                              |
| 1999–2009                               | -1.4% | -0.6% | -0.6%    | -1.0% | -1.0%               | 0.7%                              |

**Source:**

See Appendix A for Nonhighway Energy Use.

**Note:** Totals may not add due to rounding.

<sup>a</sup> Total transportation figures do not include military and off-highway energy use and may not include all possible uses of fuel for transportation (e.g., snowmobiles).



*The Environmental Protection Agency's NONROAD2008a model estimates fuel use for different types of equipment and off-highway vehicles. Most of these vehicles/equipment use diesel fuel. Recreational equipment, such as off-highway motorcycles, snowmobiles, and ATVs, are mainly fueled by gasoline.*

**Table 2.9**  
**Off-highway Transportation-related Fuel Consumption from the NonRoad Model, 2009**  
**(trillion Btus)**

|  | Gasoline     | Diesel         | LPG          | CNG          | Total          |
|--|--------------|----------------|--------------|--------------|----------------|
| Agricultural Equipment<br><i>Tractors, mowers, combines, balers, and other farm equipment which has utility in its movement.</i> | 8.3          | 543.0          | 0.0          | 0.0          | 551.3          |
| Airport Ground Equipment   | 0.3          | 13.6           | 0.2          | <sup>a</sup> | 14.1           |
| Construction and Mining Equipment<br><i>Pavers, rollers, drill rigs, graders, backhoes, excavators, cranes, mining equipment</i> | 11.4         | 868.9          | 1.8          | <sup>a</sup> | 882.2          |
| Industrial Equipment<br><i>Forklifts, terminal tractors, sweeper/scrubbers</i>   | 13.3         | 123.4          | 197.3        | 18.3         | 352.4          |
| Logging Equipment<br><i>Feller/buncher/skidder</i>   | 1.6          | 23.5           | <sup>a</sup> | <sup>a</sup> | 25.1           |
| Railroad Maintenance Equipment   | 0.2          | 3.3            | 0.0          | <sup>a</sup> | 3.5            |
| Recreational Equipment<br><i>Off-road motorcycles, snowmobiles, all-terrain vehicles, golf carts, specialty vehicles</i>         | 166.9        | 1.9            | 0.1          | <sup>a</sup> | 168.9          |
| <b>Total</b>   | <b>202.0</b> | <b>1,577.6</b> | <b>199.6</b> | <b>18.4</b>  | <b>1,997.5</b> |

**Source:**

Environmental Protection Agency, NONROAD2008a model, [www.epa.gov/otaq/nonrdmdl.htm](http://www.epa.gov/otaq/nonrdmdl.htm).

<sup>a</sup> There is no equipment listed for this fuel type.



*Mowing equipment consumes nearly half of all the fuel used by lawn and garden equipment. The gasoline used in lawn and garden equipment is 1.9% of total gasoline use.*

**Table 2.10**  
**Fuel Consumption from Lawn and Garden Equipment, 2009**  
(million gallons)

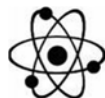
| Equipment                                  | Classification | Gasoline        | Diesel        | LPG          | Total fuel consumption |
|--|----------------|-----------------|---------------|--------------|------------------------|
| <b><i>Mowing Equipment</i></b>             |                |                 |               |              |                        |
| Front mowers                               | Commercial     | 19.49           | 106.57        | 0.00         | 126.06                 |
| Lawn & garden tractors                     | Commercial     | 225.21          | 22.00         | 0.00         | 247.20                 |
| Lawn & garden tractors                     | Residential    | 532.94          | 0.00          | 0.00         | 532.94                 |
| Lawn mowers                                | Commercial     | 150.59          | 0.00          | 0.00         | 150.59                 |
| Lawn mowers                                | Residential    | 204.05          | 0.00          | 0.00         | 204.05                 |
| Rear engine riding mowers                  | Commercial     | 16.57           | 0.00          | 0.00         | 16.57                  |
| Rear engine riding mowers                  | Residential    | 39.69           | 0.00          | 0.00         | 39.69                  |
| <b>Total</b>                               |                | <b>1,188.53</b> | <b>128.57</b> | <b>0.00</b>  | <b>1,317.10</b>        |
| <b><i>Soil and Turf Equipment</i></b>      |                |                 |               |              |                        |
| Commercial turf equipment <sup>a</sup>     | Commercial     | 726.08          | 17.10         | 0.00         | 748.18                 |
| Rotary tillers < 6 HP                      | Commercial     | 84.51           | 0.00          | 0.00         | 84.51                  |
| Rotary tillers < 6 HP                      | Residential    | 18.56           | 0.00          | 0.00         | 18.56                  |
| <b>Total</b>                               |                | <b>829.15</b>   | <b>17.10</b>  | <b>0.00</b>  | <b>846.26</b>          |
| <b><i>Wood Cutting Equipment</i></b>       |                |                 |               |              |                        |
| Chain saws < 6 HP                          | Commercial     | 72.35           | 0.00          | 0.00         | 72.35                  |
| Chain saws < 6 HP                          | Residential    | 17.60           | 0.00          | 0.00         | 17.60                  |
| Chippers/stump grinders                    | Commercial     | 38.35           | 145.02        | 18.94        | 202.31                 |
| Shredders < 6 HP                           | Commercial     | 9.07            | 0.00          | 0.00         | 9.07                   |
| <b>Total</b>                               |                | <b>137.37</b>   | <b>145.02</b> | <b>18.94</b> | <b>301.33</b>          |
| <b><i>Blowers and Vacuums</i></b>          |                |                 |               |              |                        |
| Leafblowers/vacuums                        | Commercial     | 200.80          | 0.02          | 0.00         | 200.82                 |
| Leafblowers/vacuums                        | Residential    | 17.88           | 0.00          | 0.00         | 17.88                  |
| Snowblowers                                | Commercial     | 34.18           | 1.89          | 0.00         | 36.07                  |
| Snowblowers                                | Residential    | 18.10           | 0.00          | 0.00         | 18.10                  |
| <b>Total</b>                               |                | <b>270.96</b>   | <b>1.91</b>   | <b>0.00</b>  | <b>272.87</b>          |
| <b><i>Trimming Equipment</i></b>           |                |                 |               |              |                        |
| Trimmers/edgers/brush cutter               | Commercial     | 61.18           | 0.00          | 0.00         | 61.18                  |
| Trimmers/edgers/brush cutter               | Residential    | 25.54           | 0.00          | 0.00         | 25.54                  |
| Other lawn & garden equipment <sup>b</sup> | Commercial     | 23.21           | 0.39          | 0.00         | 23.62                  |
| Other lawn & garden equipment <sup>b</sup> | Residential    | 19.45           | 0.00          | 0.00         | 19.45                  |
| <b>Total</b>                               |                | <b>129.39</b>   | <b>0.40</b>   | <b>0.00</b>  | <b>129.79</b>          |
| <b>Total All Equipment</b>                 |                | <b>2,555.40</b> | <b>293.00</b> | <b>18.94</b> | <b>2,867.33</b>        |

**Source:**

U.S. Environmental Protection Agency, NONROAD2008a Model, [www.epa.gov/otaq/nonrdmdl.htm](http://www.epa.gov/otaq/nonrdmdl.htm).

<sup>a</sup> Includes equipment such as aerators, dethatchers, sod cutters, hydro-seeders, turf utility vehicles, golf course greens mowers, and sand trap groomers.

<sup>b</sup> Includes equipment not otherwise classified such as augers, sickle-bar mowers, and wood splitters.



*The Federal Highway Administration (FHWA) cautions that data from 1993 on may not be directly comparable to earlier years. Some states have improved reporting procedures in recent years, and the estimation procedures were revised in 1994. Now, the FHWA does not publish separate estimates of gasohol or ethanol used in gasohol. See Table 2.3 for details on oxygenate usage.*

**Table 2.11**  
**Highway Usage of Gasoline and Diesel, 1973–2009**  
(billion gallons)

| Year                                    | Total gasoline and gasohol | Diesel <sup>a</sup> | Percent diesel | Total highway fuel use |
|---|----------------------------|---------------------|----------------|------------------------|
| 1973                                    | 100.6                      | 9.8                 | 8.9%           | 110.5                  |
| 1975                                    | 99.4                       | 9.6                 | 8.8%           | 109.0                  |
| 1980                                    | 101.2                      | 13.8                | 12.0%          | 115.0                  |
| 1981                                    | 99.6                       | 14.9                | 13.0%          | 114.5                  |
| 1982                                    | 98.5                       | 14.9                | 13.1%          | 113.4                  |
| 1983                                    | 100.1                      | 16.0                | 13.8%          | 116.1                  |
| 1984                                    | 101.4                      | 17.3                | 14.6%          | 118.7                  |
| 1985                                    | 103.6                      | 17.8                | 14.6%          | 121.3                  |
| 1986                                    | 106.8                      | 18.4                | 14.7%          | 125.2                  |
| 1987                                    | 108.7                      | 19.0                | 14.9%          | 127.7                  |
| 1988                                    | 109.8                      | 20.1                | 15.5%          | 129.9                  |
| 1989                                    | 110.6                      | 21.2                | 16.1%          | 131.9                  |
| 1990                                    | 110.2                      | 21.4                | 16.3%          | 131.6                  |
| 1991                                    | 107.9                      | 20.7                | 16.1%          | 128.6                  |
| 1992                                    | 111.0                      | 22.0                | 16.5%          | 132.9                  |
| 1993                                    | 113.7                      | 23.5                | 17.1%          | 137.2                  |
| 1994                                    | 115.0                      | 25.1                | 17.9%          | 140.1                  |
| 1995                                    | 117.1                      | 26.2                | 18.3%          | 143.3                  |
| 1996                                    | 119.5                      | 27.2                | 18.5%          | 146.7                  |
| 1997                                    | 120.9                      | 29.4                | 19.6%          | 150.3                  |
| 1998                                    | 124.7                      | 30.2                | 19.5%          | 154.9                  |
| 1999                                    | 128.7                      | 31.9                | 19.9%          | 160.7                  |
| 2000                                    | 128.9                      | 33.4                | 20.6%          | 162.3                  |
| 2001                                    | 129.7                      | 33.4                | 20.5%          | 163.1                  |
| 2002                                    | 133.0                      | 34.8                | 20.7%          | 167.8                  |
| 2003                                    | 134.1                      | 35.5                | 20.9%          | 169.6                  |
| 2004                                    | 136.5                      | 37.4                | 21.5%          | 173.9                  |
| 2005                                    | 135.2                      | 39.1                | 22.4%          | 174.3                  |
| 2006                                    | 134.8                      | 40.1                | 22.9%          | 174.9                  |
| 2007                                    | 135.4                      | 40.7                | 23.1%          | 176.1                  |
| 2008                                    | 132.2                      | 38.6                | 22.6%          | 170.8                  |
| 2009                                    | 132.9                      | 35.3                | 21.0%          | 168.1                  |
| <i>Average annual percentage change</i> |                            |                     |                |                        |
| 1973–2009                               | 0.8%                       | 3.6%                |                | 1.2%                   |
| 1999–2009                               | 0.3%                       | 0.6%                |                | 0.4%                   |

**Source:**

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2009*, Washington, DC, 2011, Table MF-21 and annual. (Additional resources: [www.fhwa.dot.gov](http://www.fhwa.dot.gov))

<sup>a</sup> Consists primarily of diesel fuel, with small quantities of other fuels, such as liquefied petroleum gas and E85.



*Great care should be taken when comparing modal energy intensity data among modes. Because of the inherent differences among the transportation modes in the nature of services, routes available, and many additional factors, it is not possible to obtain truly comparable national energy intensities among modes. These values are averages, and there is a great deal of variability even within a mode.*

**Table 2.12**  
**Passenger Travel and Energy Use, 2009**

|                                    | Number of<br>vehicles<br>(thousands) | Vehicle-<br>miles<br>(millions) | Passenger-<br>miles<br>(millions) | Load factor<br>(persons/<br>vehicle) | Energy intensities            |                                 | Energy use<br>(trillion Btu) |
|------------------------------------|--------------------------------------|---------------------------------|-----------------------------------|--------------------------------------|-------------------------------|---------------------------------|------------------------------|
|                                    |                                      |                                 |                                   |                                      | (Btu per<br>vehicle-<br>mile) | (Btu per<br>passenger-<br>mile) |                              |
| <b>Cars</b>                        | <b>134,880.0</b>                     | <b>1,606,815</b>                | <b>2,490,564</b>                  | <b>1.55</b>                          | <b>5,484</b>                  | <b>3,538</b>                    | <b>8,811.0</b>               |
| <b>Personal trucks</b>             | <b>88,683.4</b>                      | <b>934,631</b>                  | <b>1,719,722</b>                  | <b>1.84</b>                          | <b>6,740</b>                  | <b>3,663</b>                    | <b>6,299.4</b>               |
| <b>Motorcycles</b>                 | <b>7,929.7</b>                       | <b>20,800</b>                   | <b>24,128</b>                     | <b>1.16</b>                          | <b>2,854</b>                  | <b>2,460</b>                    | <b>59.4</b>                  |
| <b>Demand response<sup>a</sup></b> | <b>68.9</b>                          | <b>1,529</b>                    | <b>1,477</b>                      | <b>1.0</b>                           | <b>15,111</b>                 | <b>15,645</b>                   | <b>23.1</b>                  |
| <b>Buses</b>                       | <sup>b</sup>                         | <sup>b</sup>                    | <sup>b</sup>                      | <sup>b</sup>                         | <sup>b</sup>                  | <sup>b</sup>                    | <b>200.0</b>                 |
| Transit                            | 65.4                                 | 2,345                           | 21,645                            | 9.2                                  | 39,160                        | 4,242                           | 91.8                         |
| Intercity <sup>c</sup>             | <sup>b</sup>                         | <sup>b</sup>                    | <sup>b</sup>                      | <sup>b</sup>                         | <sup>b</sup>                  | <sup>b</sup>                    | 31.4                         |
| School <sup>c</sup>                | 683.7                                | <sup>b</sup>                    | <sup>b</sup>                      | <sup>b</sup>                         | <sup>b</sup>                  | <sup>b</sup>                    | 76.9                         |
| <b>Air</b>                         | <sup>b</sup>                         | <sup>b</sup>                    | <sup>b</sup>                      | <sup>b</sup>                         | <sup>b</sup>                  | <sup>b</sup>                    | <b>1,751.4</b>               |
| Certificated route <sup>d</sup>    | <sup>b</sup>                         | 5,453                           | 541,646                           | 99.3                                 | 280,734                       | 2,826                           | 1,530.8                      |
| General aviation                   | 223.9                                | <sup>b</sup>                    | <sup>b</sup>                      | <sup>b</sup>                         | <sup>b</sup>                  | <sup>b</sup>                    | 220.6                        |
| <b>Recreational boats</b>          | <b>13,290.7</b>                      | <sup>b</sup>                    | <sup>b</sup>                      | <sup>b</sup>                         | <sup>b</sup>                  | <sup>b</sup>                    | <b>245.7</b>                 |
| <b>Rail</b>                        | <b>20.7</b>                          | <b>1,402</b>                    | <b>36,150</b>                     | <b>25.8</b>                          | <b>66,916</b>                 | <b>2,594</b>                    | <b>93.8</b>                  |
| Intercity (Amtrak)                 | 0.3                                  | 283                             | 5,914                             | 20.9                                 | 50,924                        | 2,435                           | 14.4                         |
| Transit                            | 13.5                                 | 775                             | 19,004                            | 24.5                                 | 61,663                        | 2,516                           | 47.8                         |
| Commuter                           | 6.9                                  | 344                             | 11,232                            | 32.7                                 | 91,936                        | 2,812                           | 31.6                         |

**Source:**

See Appendix A for Passenger Travel and Energy Use.

<sup>a</sup> Includes passenger cars, vans, and small buses operating in response to calls from passengers to the transit operator who dispatches the vehicles.

<sup>b</sup> Data are not available.

<sup>c</sup> Energy use is estimated.

<sup>d</sup> Only domestic service and domestic energy use are shown on this table. (Previous editions included half of international energy.) These energy intensities may be inflated because all energy use is attributed to passengers—cargo energy use is not taken into account.





*Great care should be taken when comparing modal energy intensity data among modes. Because of the inherent differences among the transportation modes in the nature of services, routes available, and many additional factors, it is not possible to obtain truly comparable national energy intensities among modes. These values are averages, and there is a great deal of variability even within a mode.*

**Table 2.13**  
**Energy Intensities of Highway Passenger Modes, 1970–2009**

| Year                                    | Automobiles            |                          | Light truck <sup>a</sup><br>(Btu per vehicle-mile) | Transit Buses <sup>b</sup> |                          |
|---|------------------------|--------------------------|--|----------------------------|--------------------------|
|   | (Btu per vehicle-mile) | (Btu per passenger-mile) |  | (Btu per vehicle-mile)     | (Btu per passenger-mile) |
| 1970                                    | 9,250                  | 4,868                    | 12,480   | 31,796                     | 2,472                    |
| 1975                                    | 8,993                  | 4,733                    | 11,879   | 33,748                     | 2,814                    |
| 1976                                    | 9,113                  | 4,796                    | 11,524   | 34,598                     | 2,896                    |
| 1977                                    | 8,950                  | 4,710                    | 11,160   | 35,120                     | 2,889                    |
| 1978                                    | 8,839                  | 4,693                    | 10,807   | 36,603                     | 2,883                    |
| 1979                                    | 8,647                  | 4,632                    | 10,468   | 36,597                     | 2,795                    |
| 1980                                    | 7,916                  | 4,279                    | 10,224   | 36,553                     | 2,813                    |
| 1981                                    | 7,670                  | 4,184                    | 9,997  | 37,745                     | 3,027                    |
| 1982                                    | 7,465                  | 4,109                    | 9,268  | 38,766                     | 3,237                    |
| 1983                                    | 7,365                  | 4,092                    | 9,124  | 37,962                     | 3,177                    |
| 1984                                    | 7,202                  | 4,066                    | 8,931  | 38,705                     | 3,307                    |
| 1985                                    | 7,164                  | 4,110                    | 8,730  | 38,876                     | 3,423                    |
| 1986                                    | 7,194                  | 4,197                    | 8,560  | 37,889                     | 3,545                    |
| 1987                                    | 6,959                  | 4,128                    | 8,359  | 36,247                     | 3,594                    |
| 1988                                    | 6,683                  | 4,033                    | 8,119  | 36,673                     | 3,706                    |
| 1989                                    | 6,589                  | 4,046                    | 7,746  | 36,754                     | 3,732                    |
| 1990                                    | 6,169                  | 3,856                    | 7,746  | 37,374                     | 3,794                    |
| 1991                                    | 5,912                  | 3,695                    | 7,351  | 37,732                     | 3,877                    |
| 1992                                    | 5,956                  | 3,723                    | 7,239  | 40,243                     | 4,310                    |
| 1993                                    | 6,087                  | 3,804                    | 7,182  | 39,043                     | 4,262                    |
| 1994                                    | 6,024                  | 3,765                    | 7,212  | 37,259                     | 4,262                    |
| 1995                                    | 5,902                  | 3,689                    | 7,208  | 37,251                     | 4,307                    |
| 1996                                    | 5,874                  | 3,683                    | 7,247  | 37,452                     | 4,340                    |
| 1997                                    | 5,797                  | 3,646                    | 7,251  | 38,861                     | 4,434                    |
| 1998                                    | 5,767                  | 3,638                    | 7,260  | 41,296                     | 4,399                    |
| 1999                                    | 5,821                  | 3,684                    | 7,327  | 40,578                     | 4,344                    |
| 2000                                    | 5,687                  | 3,611                    | 7,158  | 41,695                     | 4,531                    |
| 2001                                    | 5,626                  | 3,583                    | 7,080  | 38,535                     | 4,146                    |
| 2002                                    | 5,662                  | 3,607                    | 7,125  | 37,548                     | 4,133                    |
| 2003                                    | 5,535                  | 3,525                    | 7,673  | 37,096                     | 4,213                    |
| 2004                                    | 5,489                  | 3,496                    | 7,653  | 37,855                     | 4,364                    |
| 2005                                    | 5,607                  | 3,571                    | 7,009  | 37,430                     | 4,250                    |
| 2006                                    | 5,511                  | 3,510                    | 6,974  | 39,568                     | 4,316                    |
| 2007                                    | 5,513                  | 3,512                    | 6,904  | 39,931                     | 4,372                    |
| 2008                                    | 5,465                  | 3,526                    | 6,830  | 39,906                     | 4,348                    |
| 2009                                    | 5,484                  | 3,538                    | 6,862  | 39,160                     | 4,242                    |
| <i>Average annual percentage change</i> |                        |                          |  |                            |                          |
| 1970–2009                               | -1.3%                  | -0.8%                    | -1.5%  | 0.5%                       | 1.4%                     |
| 1999–2009                               | -0.6%                  | -0.4%                    | -0.7%  | -0.4%                      | -0.2%                    |

**Source:**

See Appendix A for Highway Passenger Mode Energy Intensities.

<sup>a</sup> All two-axle, four-tire trucks.

<sup>b</sup> Series not continuous between 1983 and 1984 because of a change in data source by the American Public Transportation Association (APTA).



*Great care should be taken when comparing modal energy intensity data among modes. Because of the inherent differences between the transportation modes in the nature of services, routes available, and many additional factors, it is not possible to obtain truly comparable national energy intensities among modes.*

**Table 2.14**  
**Energy Intensities of Nonhighway Passenger Modes, 1970–2009**

| Year  | Air  | Rail   |  |   |
|---|--|--|--|---|
|   | Certificated air carriers <sup>a</sup><br>(Btu per passenger-mile) | Intercity Amtrak<br>(Btu per passenger-mile) | Rail transit<br>(Btu per passenger-mile) | Commuter rail<br>(Btu per passenger-mile) |
| 1970  | 10,115   | <sup>b</sup>                                 | 2,157                                    | <sup>b</sup>                              |
| 1975  | 7,625  | 3,548  | 2,625                                    | <sup>b</sup>                              |
| 1976  | 7,282  | 3,278  | 2,633                                    | <sup>b</sup>                              |
| 1977  | 6,990  | 3,443  | 2,364                                    | <sup>b</sup>                              |
| 1978  | 6,144  | 3,554  | 2,144                                    | <sup>b</sup>                              |
| 1979  | 5,607  | 3,351  | 2,290                                    | <sup>b</sup>                              |
| 1980  | 5,561  | 3,065  | 2,312                                    | <sup>b</sup>                              |
| 1981  | 5,774  | 2,883  | 2,592                                    | <sup>b</sup>                              |
| 1982  | 5,412  | 3,052  | 2,699                                    | <sup>b</sup>                              |
| 1983  | 5,133  | 2,875  | 2,820                                    | <sup>b</sup>                              |
| 1984  | 5,298  | 2,923  | 3,037                                    | 2,804                                     |
| 1985  | 5,053  | 2,703  | 2,809                                    | 2,826                                     |
| 1986  | 5,011  | 2,481  | 3,042                                    | 2,926                                     |
| 1987  | 4,827  | 2,450  | 3,039                                    | 2,801                                     |
| 1988  | 4,861  | 2,379  | 3,072                                    | 2,872                                     |
| 1989  | 4,844  | 2,614  | 2,909                                    | 2,864                                     |
| 1990  | 4,875  | 2,505  | 3,024                                    | 2,822                                     |
| 1991  | 4,662  | 2,417  | 3,254                                    | 2,770                                     |
| 1992  | 4,516  | 2,534  | 3,155                                    | 2,629                                     |
| 1993  | 4,490  | 2,565  | 3,373                                    | 2,976                                     |
| 1994  | 4,397  | 2,282  | 3,338                                    | 2,682                                     |
| 1995  | 4,349  | 2,501  | 3,340                                    | 2,632                                     |
| 1996  | 4,172  | 2,690  | 3,017                                    | 2,582                                     |
| 1997  | 4,166  | 2,811  | 2,856                                    | 2,724                                     |
| 1998  | 4,146  | 2,788  | 2,823                                    | 2,646                                     |
| 1999  | 4,061  | 2,943  | 2,785                                    | 2,714                                     |
| 2000  | 3,952  | 3,235  | 2,797                                    | 2,551                                     |
| 2001  | 3,968  | 3,257  | 2,803                                    | 2,515                                     |
| 2002  | 3,703  | 3,212  | 2,872                                    | 2,514                                     |
| 2003  | 3,587  | 2,800  | 2,837                                    | 2,545                                     |
| 2004  | 3,339  | 2,760  | 2,750                                    | 2,569                                     |
| 2005  | 3,264  | 2,709  | 2,783                                    | 2,743                                     |
| 2006  | 3,250  | 2,650  | 2,707                                    | 2,527                                     |
| 2007  | 3,153  | 2,516  | 2,577                                    | 2,638                                     |
| 2008  | 3,051  | 2,398  | 2,521                                    | 2,656                                     |
| 2009  | 2,901  | 2,435  | 2,516                                    | 2,812                                     |
| <i>Average annual percentage change<sup>c</sup></i> |  |  |  |   |
| 1970–2009   | -3.2%  | -1.1%  | 0.5%                                     | 0.0%                                      |
| 1999–2009   | -3.3%  | -1.9%  | -1.0%                                    | 0.4%                                      |

**Source:**

See Appendix A for Nonhighway Passenger Mode Energy Intensities.

<sup>a</sup> These data differ from the data on Table 2.12 because they include half of international services. These energy intensities may be inflated because all energy use is attributed to passengers—cargo energy use is not taken into account.

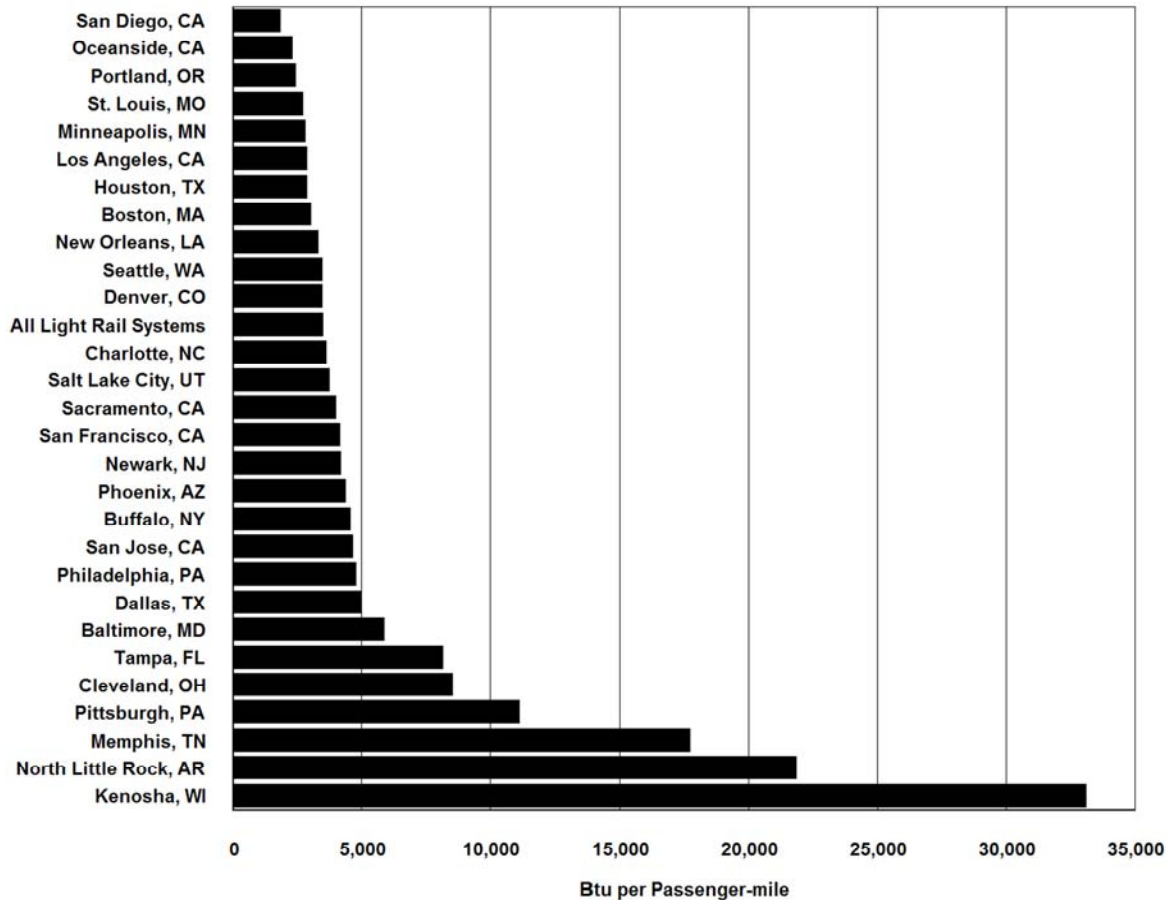
<sup>b</sup> Data are not available.

<sup>c</sup> Average annual percentage calculated to earliest year possible.



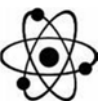
*The energy intensity of light rail systems, measured in btu per passenger-mile varies greatly. The weighted average of all light rail systems in 2009 is 3,526 btu/passenger-mile.*

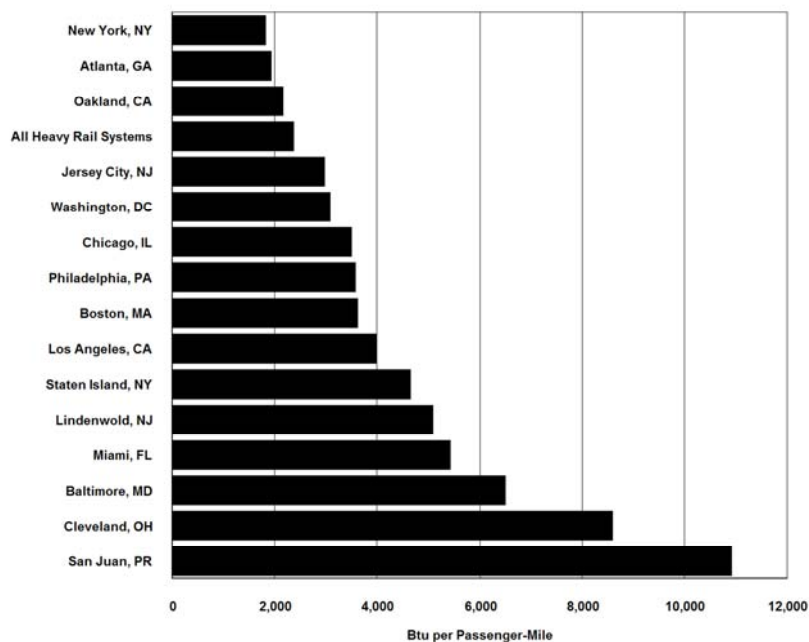
**Figure 2.2. Energy Intensity of Light Rail Transit Systems, 2009**



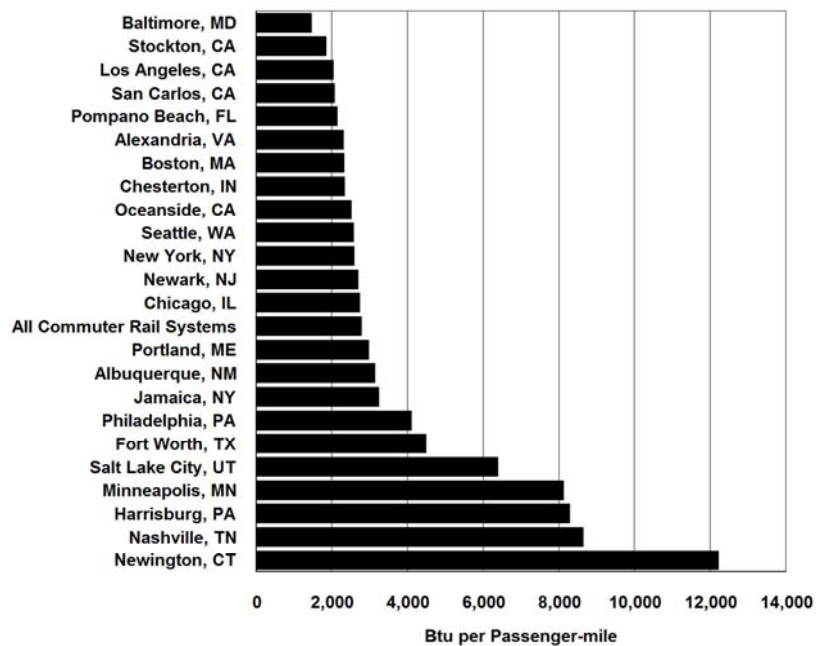
**Source:**

U.S. Department of Transportation, *National Transit Database*, May 2011. (Additional resources: <http://204.68.195.57/ntdprogram/data.htm>)



**Figure 2.3. Energy Intensity of Heavy Rail Systems, 2009****Source:**

U.S. Department of Transportation, *National Transit Database*, May 2011. (Additional resources: [www.ntdprogram.gov](http://www.ntdprogram.gov))

**Figure 2.4. Energy Intensity of Commuter Rail Systems, 2009****Source:**

U.S. Department of Transportation, *National Transit Database*, May 2011. (Additional resources: [www.ntdprogram.gov](http://www.ntdprogram.gov))



*Great care should be taken when comparing modal energy intensity data among modes. Because of the inherent differences between the transportation modes in the nature of services, routes available, and many additional factors, it is not possible to obtain truly comparable national energy intensities among modes.*

**Table 2.15**  
**Energy Intensities of Freight Modes, 1970–2009**

| Year                                    | Heavy single-unit and<br>combination trucks<br>(Btu per vehicle-mile) | Class I freight railroad   |                    |
|---|---|----------------------------|--------------------|
|   |   | (Btu per freight car-mile) | (Btu per ton-mile) |
| 1970                                    | 24,960  | 17,669                     | 691                |
| 1971                                    | 24,485  | 18,171                     | 717                |
| 1972                                    | 24,668  | 18,291                     | 714                |
| 1973                                    | 24,777  | 18,468                     | 677                |
| 1974                                    | 24,784  | 18,852                     | 681                |
| 1975                                    | 24,631  | 18,739                     | 687                |
| 1976                                    | 24,567  | 18,938                     | 680                |
| 1977                                    | 24,669  | 19,226                     | 669                |
| 1978                                    | 24,655  | 18,928                     | 641                |
| 1979                                    | 24,746  | 19,188                     | 618                |
| 1980                                    | 24,758  | 18,742                     | 597                |
| 1981                                    | 25,059  | 18,629                     | 572                |
| 1982                                    | 24,297  | 18,404                     | 553                |
| 1983                                    | 23,853  | 17,864                     | 525                |
| 1984                                    | 23,585  | 17,795                     | 510                |
| 1985                                    | 23,343  | 17,500                     | 497                |
| 1986                                    | 23,352  | 17,265                     | 486                |
| 1987                                    | 22,923  | 16,790                     | 456                |
| 1988                                    | 22,596  | 16,758                     | 443                |
| 1989                                    | 22,411  | 16,894                     | 437                |
| 1990                                    | 22,795  | 16,619                     | 420                |
| 1991                                    | 22,749  | 15,835                     | 391                |
| 1992                                    | 22,609  | 16,043                     | 393                |
| 1993                                    | 22,373  | 16,056                     | 389                |
| 1994                                    | 22,193  | 16,340                     | 388                |
| 1995                                    | 22,097  | 15,992                     | 372                |
| 1996                                    | 22,109  | 15,747                     | 368                |
| 1997                                    | 21,340  | 15,784                     | 370                |
| 1998                                    | 21,516  | 15,372                     | 365                |
| 1999                                    | 22,884  | 15,363                     | 363                |
| 2000                                    | 23,449  | 14,917                     | 352                |
| 2001                                    | 23,024  | 15,108                     | 346                |
| 2002                                    | 23,462  | 15,003                     | 345                |
| 2003                                    | 22,461  | 15,016                     | 344                |
| 2004                                    | 20,540  | 15,274                     | 341                |
| 2005                                    | 22,866  | 15,152                     | 337                |
| 2006                                    | 23,340  | 14,990                     | 330                |
| 2007                                    | 21,238  | 14,846                     | 320                |
| 2008                                    | 21,008  | 14,573                     | 305                |
| 2009                                    | 21,127  | 13,907                     | 291                |
| <i>Average annual percentage change</i> |   |                            |                    |
| 1970–2009                               | -0.4%   | -0.6%                      | -2.2%              |
| 1999–2009                               | -0.8%   | -1.0%                      | -2.2%              |

**Source:**

See Appendix A for Freight Mode Energy Intensities.

**Note:** Due to changes in the FHWA fuel use methodology, truck data are not comparable with data before the year 2007.





## Chapter 3

# All Highway Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

| Source    |   |           |
|-----------|---|-----------|
| Table 3.1 | U.S. share of world car registrations, 2009         | 19.4%     |
| Table 3.2 | U.S. share of world truck & bus registrations, 2009 | 40.8%     |
| Table 3.3 | Number of U.S. cars, 2009 (thousands)               | 132,424   |
| Table 3.3 | Number of U.S. trucks, 2009 (thousands)             | 116,036   |
| Table 3.6 | Vehicle miles traveled, 2009 (million miles)        | 2,953,501 |
|           | <i>Cars</i>   | 52.7%     |
|           | <i>Two-axle, four-tire trucks</i>                   | 36.4%     |
|           | <i>Combination trucks</i>                           | 5.7%      |
|           | <i>Other single-unit trucks</i>                     | 4.1%      |
|           | <i>Motorcycles</i>                                  | 0.7%      |
|           | <i>Buses</i>  | 0.5%      |
| Table 3.9 | Average age of vehicles, 2009                       |           |
|           | <i>Cars (years)</i>                                 | 10.6      |
|           | <i>Light trucks (years)</i>                         | 9.6       |
|           | <i>All trucks (years)</i>                           | 10.2      |



*Use caution comparing historical data because of disconnects in data series. Also, the United States is unique in how many light trucks (SUVs, minivans, pickups) are used for personal travel. Those light trucks are not included on this table. The U.S. share of world cars continues to decline. The growth in the World total comes mainly from developing countries, like China and India.*

**Table 3.1**  
**Car Registrations for Selected Countries, 1960–2009**  
(thousands)

| Country                  | 1960   | 1970    | 1980    | 1990    | 2000    | 2005    | 2007    | 2008    | 2009    | Average Annual Percentage Change 1990-2009 |
|--------------------------|--------|---------|---------|---------|---------|---------|---------|---------|---------|--|
| Argentina                | 474    | 1,482   | 3,112   | 4,284   | 5,060   | 5,340   | 6,004   | 6,244   | 6,465   | 2.2%                                       |
| Brazil                   | a      | a       | a       | 12,127  | 15,393  | 18,370  | 20,430  | 21,884  | 23,612  | 3.6%                                       |
| Canada <sup>b</sup>      | 4,104  | 6,602   | 10,256  | 12,622  | 16,832  | 18,124  | 19,199  | 19,613  | 19,877  | 2.4%                                       |
| China                    | a      | a       | 351     | 1,897   | 3,750   | 8,900   | 13,758  | 18,270  | 25,301  | 14.6%                                      |
| France                   | 4,950  | 11,860  | 18,440  | 23,550  | 28,060  | 30,100  | 30,550  | 30,850  | 31,050  | 1.5%                                       |
| Germany <sup>c</sup>     | 4,856  | 14,376  | 23,236  | 35,512  | 43,772  | 46,090  | 41,184  | 41,321  | 41,738  | 0.9%                                       |
| India                    | a      | a       | a       | 2,300   | 5,150   | 7,654   | 8,595   | 9,400   | 10,400  | 8.3%                                       |
| Indonesia                | a      | a       | a       | 1,200   | a       | 3,850   | 4,355   | 4,750   | 5,005   | 7.8%                                       |
| Japan                    | 457    | 8,779   | 23,660  | 34,924  | 52,437  | 57,091  | 57,624  | 57,865  | 58,020  | 2.7%                                       |
| Malaysia                 | a      | a       | a       | 1,811   | 4,213   | 6,402   | 6,804   | 7,190   | 7,375   | 7.7%                                       |
| Pakistan                 | a      | a       | a       | a       | 375     | 411     | 428     | 445     | 460     | -2.5%                                      |
| Russia                   | a      | a       | a       | a       | 20,353  | 25,285  | 28,300  | 32,021  | 33,187  | a  |
| United Kingdom           | 5,650  | 11,802  | 15,438  | 22,528  | 27,185  | 30,652  | 31,225  | 31,252  | 31,036  | 1.7%                                       |
| United States            | 61,671 | 89,244  | 121,601 | 143,550 | 127,721 | 132,909 | 135,222 | 135,882 | 132,424 | -0.4%                                      |
| U.S. Percentage of World | 62.7%  | 46.1%   | 38.0%   | 32.3%   | 23.3%   | 21.5%   | 20.9%   | 20.4%   | 19.4%   |  |
| World total              | 98,305 | 193,479 | 320,390 | 444,900 | 548,558 | 617,914 | 645,837 | 667,630 | 681,154 | 2.3%                                       |

**Source:**

Ward's Communications, *Ward's World Motor Vehicle Data, 2010 Edition*, Southfield, MI, 2010, pp. 271–274 and annual. (Additional resources: [www.wardsauto.com](http://www.wardsauto.com))

<sup>a</sup> Data are not available.

<sup>b</sup> Data from 2000 and later are not comparable to prior data. Canada reclassified autos and trucks prior to 2000.

<sup>c</sup> Data for 1990 and prior include West Germany only. Kraftwagen are included with automobiles.





*The United States totals include SUVs, minivans, and light trucks, many of which are used for personal travel.*

**Table 3.2**  
**Truck and Bus Registrations for Selected Countries, 1960–2009**  
(thousands)

| Country                  | 1960   | 1970   | 1980   | 1990    | 2000    | 2005    | 2009    | Average Annual Percentage Change 1990-2009 |
|--------------------------|--------|--------|--------|---------|---------|---------|---------|--|
| Argentina                | 392    | 788    | 1,217  | 1,501   | 1,554   | 1,730   | 2,296   | 2.3%                                       |
| Brazil                   | a      | a      | a      | 936     | 3,917   | 4,653   | 6,031   | 10.3%                                      |
| Canada <sup>b</sup>      | 1,056  | 1,481  | 2,955  | 3,931   | 739     | 786     | 915     | -7.4%                                      |
| China                    | a      | a      | 1,480  | 4,314   | 9,650   | 21,750  | 35,875  | 11.8%                                      |
| France                   | 1,650  | 1,850  | 2,550  | 4,910   | 5,733   | 6,198   | 6,388   | 1.4%                                       |
| India                    | a      | a      | a      | 2,050   | 2,390   | 4,145   | 6,250   | 6.0%                                       |
| Indonesia                | a      | a      | a      | 1,391   | 2,373   | 2,950   | 3,625   | 5.2%                                       |
| Germany <sup>c</sup>     | 786    | 1,228  | 1,617  | 2,764   | 3,534   | 3,133   | 2,895   | 0.2%                                       |
| Japan                    | 896    | 8,803  | 14,197 | 22,773  | 20,211  | 16,734  | 15,789  | -1.9%                                      |
| Malaysia                 | a      | a      | a      | 616     | 1,030   | 1,323   | 1,525   | 4.9%                                       |
| Pakistan                 | a      | a      | a      | 172     | 385     | 414     | 465     | 5.4%                                       |
| Russia                   | a      | a      | a      | 7,200   | 5,041   | 5,705   | 6,323   | -0.7%                                      |
| United Kingdom           | 1,534  | 1,769  | 1,920  | 3,774   | 3,361   | 3,943   | 4,182   | 0.5%                                       |
| United States            | 12,186 | 19,175 | 34,195 | 45,106  | 85,579  | 104,788 | 116,036 | 5.1%                                       |
| U.S. Percentage of World | 42.6%  | 36.2%  | 37.7%  | 32.7%   | 42.1%   | 42.6%   | 40.8%   |  |
| World total              | 28,583 | 52,899 | 90,592 | 138,082 | 203,272 | 245,798 | 284,101 | 3.9%                                       |

**Source:**

Ward's Communications, *Ward's World Motor Vehicle Data, 2010 Edition*, Southfield, MI, 2010, pp. 271–274 and annual. (Additional resources: [www.wardsauto.com](http://www.wardsauto.com))

<sup>a</sup> Data are not available.

<sup>b</sup> Data from 2000 and later are not comparable to prior data. Canada reclassified autos and trucks prior to 2000.

<sup>c</sup> Data for 1990 and prior include West Germany only. Kraftwagen are included with automobiles.



## VEHICLES IN USE

Both the Federal Highway Administration (FHWA) and The Polk Company report figures on the car and truck population each year. The two estimates, however, differ by as much as 11.2% (1981). The differences can be attributed to several factors:

- The FHWA data include all vehicles which have been registered at any time throughout the calendar year. Therefore, the data include vehicles which were retired during the year and may double count vehicles which have been registered in different states or the same states to different owners. The Polk Company data include only those vehicles which are registered on July 1 of the given year.
- The classification of mini-vans, station wagons on truck chassis, and utility vehicles as cars or trucks causes important differences in the two estimates. The Polk Company data included passenger vans in the car count until 1980; since 1980 all vans have been counted as trucks. Recently, the Federal Highway Administration adjusted their definition of cars and trucks. Starting in 1993, some minivans and sport utility vehicles that were previously included with cars were included with trucks. This change produced a dramatic change in the individual percentage differences of cars and trucks. The difference in total vehicles has been less than 5% each year since 1990 and does not appear to be significantly affected by the FHWA reclassifications.
- The FHWA data include all non-military Federal vehicles, while The Polk Company data include only those Federal vehicles which are registered within a state. Federal vehicles are not required to have State registrations, and, according to the General Services Administration, most Federal Vehicles are not registered.

According to The Polk Company statistics, the number of cars in use in the United States declined from 1991 to 1992. This is the first decline in vehicle stock since the figures were first reported in 1924. However, the data should be viewed with caution. A redesign of Polk's approach in 1992 allowed a national check for duplicate registrations, which was not possible in earlier years. Polk estimates that, due to processing limitations, its vehicle population counts may have been inflated by as much as 1½ percent. Assuming that percentage is correct, the number of cars in use would have declined from 1991 to 1992 under the previous Polk method. The growing popularity of light trucks being used as passenger vehicles could also have had an impact on these figures.



*In the early 1980's, researchers had to make a conscience choice of which data series to use, since they differed by as much as 11%. In 2009 the two sources differed by about 1%. Both sources show a decline in automobiles from 2008 to 2009 and an increase in trucks. The series, however, seem to be growing further apart.*

**Table 3.3**  
**U.S. Cars and Trucks in Use, 1970–2009**  
**(thousands)**

| Year | Automobiles |                  |                       | Trucks  |                  |                       | Total   |                  |                       |
|------|-------------|------------------|-----------------------|---------|------------------|-----------------------|---------|------------------|-----------------------|
|      | FHWA        | The Polk Company | Percentage difference | FHWA    | The Polk Company | Percentage difference | FHWA    | The Polk Company | Percentage difference |
| 1970 | 89,243      | 80,448           | 10.9%                 | 18,797  | 17,688           | 6.3%                  | 108,040 | 98,136           | 10.1%                 |
| 1975 | 106,706     | 95,241           | 12.0%                 | 25,781  | 24,813           | 3.9%                  | 132,487 | 120,054          | 10.4%                 |
| 1976 | 110,189     | 97,818           | 12.6%                 | 27,876  | 26,560           | 5.0%                  | 138,065 | 124,378          | 11.0%                 |
| 1977 | 112,288     | 99,904           | 12.4%                 | 29,314  | 28,222           | 3.9%                  | 141,602 | 128,126          | 10.5%                 |
| 1978 | 116,573     | 102,957          | 13.2%                 | 31,336  | 30,565           | 2.5%                  | 147,909 | 133,522          | 10.8%                 |
| 1979 | 118,429     | 104,677          | 13.1%                 | 32,914  | 32,583           | 1.0%                  | 151,343 | 137,260          | 10.3%                 |
| 1980 | 121,601     | 104,564          | 16.3%                 | 33,667  | 35,268           | -4.5%                 | 155,267 | 139,832          | 11.0%                 |
| 1981 | 123,098     | 105,839          | 16.3%                 | 34,644  | 36,069           | -4.0%                 | 157,743 | 141,908          | 11.2%                 |
| 1982 | 123,702     | 106,867          | 15.8%                 | 35,382  | 36,987           | -4.3%                 | 159,084 | 143,854          | 10.6%                 |
| 1983 | 126,444     | 108,961          | 16.0%                 | 36,723  | 38,143           | -3.7%                 | 163,166 | 147,104          | 10.9%                 |
| 1984 | 128,158     | 112,019          | 14.4%                 | 37,507  | 40,143           | -6.6%                 | 165,665 | 152,162          | 8.9%                  |
| 1985 | 127,885     | 114,662          | 11.5%                 | 43,210  | 42,387           | 1.9%                  | 171,095 | 157,049          | 8.9%                  |
| 1986 | 130,004     | 117,268          | 10.9%                 | 45,103  | 44,826           | 0.6%                  | 175,106 | 162,094          | 8.0%                  |
| 1987 | 131,482     | 119,849          | 9.7%                  | 46,826  | 47,344           | -1.1%                 | 178,308 | 167,193          | 6.6%                  |
| 1988 | 133,836     | 121,519          | 10.1%                 | 49,941  | 50,221           | -0.6%                 | 183,777 | 171,740          | 7.0%                  |
| 1989 | 134,559     | 122,758          | 9.6%                  | 52,172  | 53,202           | -1.9%                 | 186,731 | 175,960          | 6.1%                  |
| 1990 | 133,700     | 123,276          | 8.5%                  | 54,470  | 56,023           | -2.8%                 | 188,171 | 179,299          | 4.9%                  |
| 1991 | 128,300     | 123,268          | 4.1%                  | 59,206  | 58,179           | 1.8%                  | 187,505 | 181,447          | 3.3%                  |
| 1992 | 126,581     | 120,347          | 5.2%                  | 63,136  | 61,172           | 3.2%                  | 189,717 | 181,519          | 4.5%                  |
| 1993 | 127,327     | 121,055          | 5.2%                  | 66,082  | 65,260           | 1.3%                  | 193,409 | 186,315          | 3.8%                  |
| 1994 | 127,883     | 121,997          | 4.8%                  | 69,491  | 66,717           | 4.2%                  | 197,375 | 188,714          | 4.6%                  |
| 1995 | 128,387     | 123,242          | 4.2%                  | 72,458  | 70,199           | 3.2%                  | 200,845 | 193,441          | 3.8%                  |
| 1996 | 129,728     | 124,613          | 4.1%                  | 75,940  | 73,681           | 3.1%                  | 205,669 | 198,294          | 3.7%                  |
| 1997 | 129,749     | 124,673          | 4.1%                  | 77,307  | 76,398           | 1.2%                  | 207,056 | 201,071          | 3.0%                  |
| 1998 | 131,839     | 125,966          | 4.7%                  | 79,062  | 79,077           | 0.0%                  | 210,901 | 205,043          | 2.9%                  |
| 1999 | 132,432     | 126,869          | 4.4%                  | 83,148  | 82,640           | 0.6%                  | 215,580 | 209,509          | 2.9%                  |
| 2000 | 133,621     | 127,721          | 4.6%                  | 87,108  | 85,579           | 1.8%                  | 220,729 | 213,300          | 3.5%                  |
| 2001 | 137,633     | 128,714          | 6.9%                  | 92,045  | 87,969           | 4.6%                  | 229,678 | 216,683          | 6.0%                  |
| 2002 | 135,921     | 129,907          | 4.6%                  | 92,939  | 91,120           | 2.0%                  | 228,860 | 221,027          | 3.5%                  |
| 2003 | 135,670     | 131,072          | 3.5%                  | 94,944  | 94,810           | 0.1%                  | 230,614 | 225,882          | 2.1%                  |
| 2004 | 136,431     | 132,469          | 3.0%                  | 100,016 | 99,698           | 0.3%                  | 236,447 | 232,167          | 1.8%                  |
| 2005 | 136,568     | 132,909          | 2.8%                  | 103,819 | 105,475          | -1.6%                 | 240,387 | 238,384          | 0.8%                  |
| 2006 | 135,400     | 135,047          | 0.3%                  | 107,944 | 109,596          | -1.5%                 | 243,344 | 244,643          | -0.5%                 |
| 2007 | 135,933     | 135,222          | 0.5%                  | 110,498 | 113,479          | -2.6%                 | 246,431 | 248,701          | -0.9%                 |
| 2008 | 137,080     | 135,882          | 0.9%                  | 110,242 | 114,357          | -3.6%                 | 247,322 | 250,239          | -1.2%                 |
| 2009 | 134,880     | 132,424          | 1.9%                  | 110,561 | 116,036          | -4.7%                 | 245,441 | 248,460          | -1.2%                 |

**Source:**

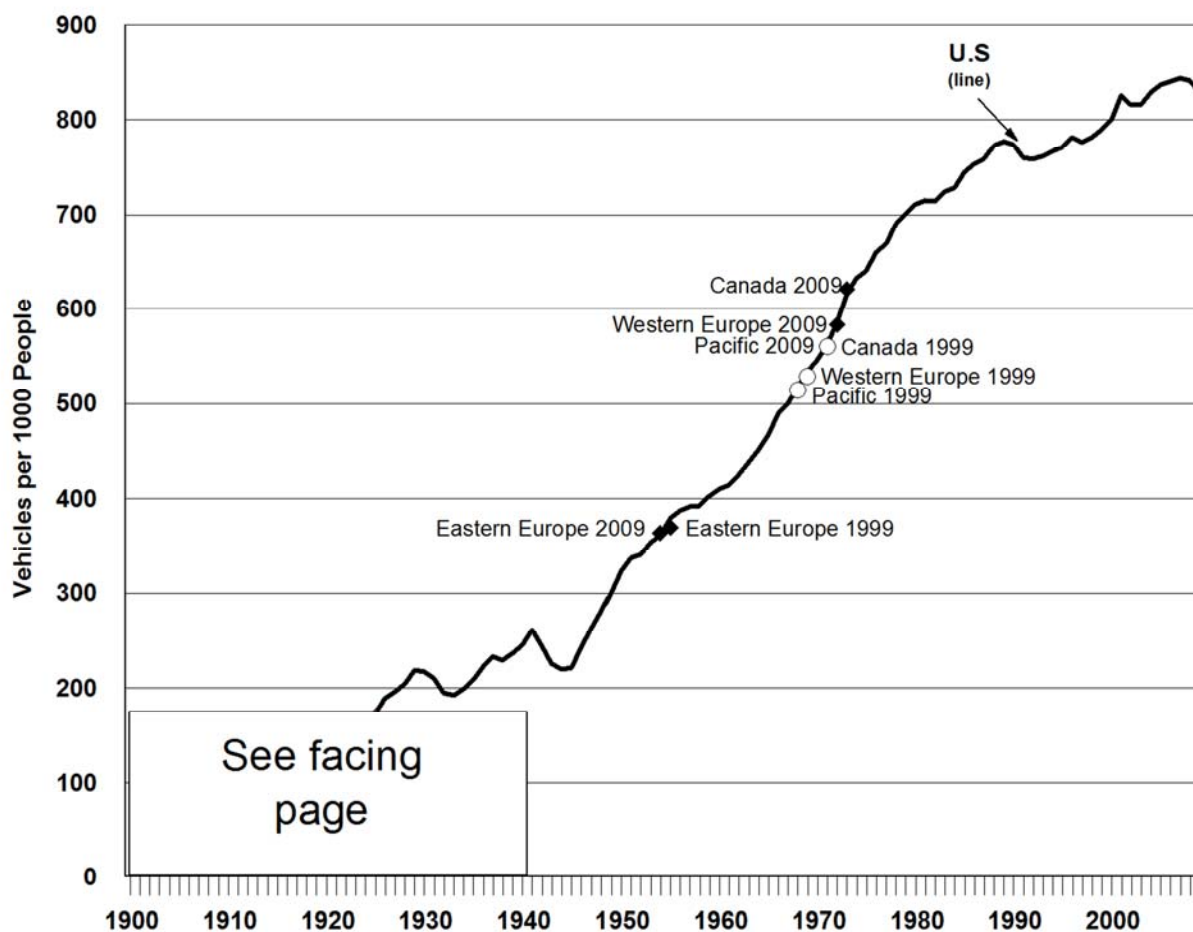
FHWA - U.S. Department of Transportation, Federal Highway Administration, 1970-2008, *Highway Statistics 2008*, Washington, DC, 2009, Table VM-1 and annual. 2009 data from tables MV-1 and MV-9. (Additional resources: [www.fhwa.dot.gov](http://www.fhwa.dot.gov))

Polk - The Polk Company, Detroit, Michigan. **FURTHER REPRODUCTION PROHIBITED.** (Additional resources: [www.polk.com](http://www.polk.com))



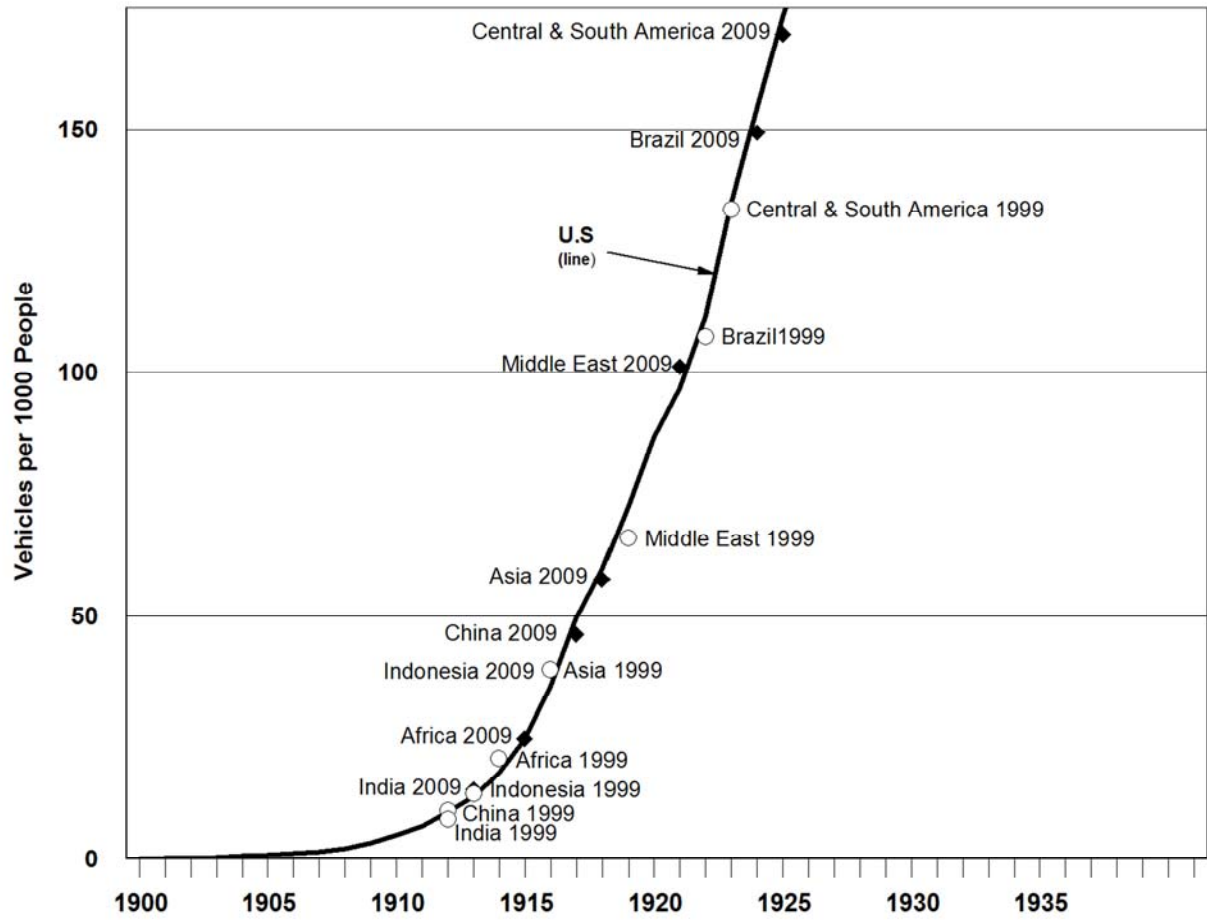
The graphs below show the number of motor vehicles per thousand people for various countries. The data for the United States are displayed in the line which goes from 1900 to 2009. The points labeled on that line show data for the other countries/regions around the world and how their vehicles per thousand people compare to the United States at two different points in time, 1999 and 2009. For instance, the graph shows that in 1999, Western Europe's vehicles per thousand people was about where the United States was in 1969, but by 2009 it is about where the United States was in 1972. The lower part of the graph (1900-1940) is shown enlarged on the facing page.

**Figure 3.1. Vehicles per Thousand People: U.S. (Over Time) Compared to Other Countries (in 1999 and 2009)**



See facing  
page





**Source:**  
See Tables 3.4 and 3.5.



*Though some countries are listed separately in this table, those countries are also included in the regional total. For instance, China is listed separately, but is also included in the Asia, Far East region.*

**Table 3.4**  
**Vehicles per Thousand People in Other Countries, 1999 and 2009**

| Country/Region          | Vehicles per 1,000 people |       |
|-------------------------|---------------------------|-------|
|                         | 1999                      | 2009  |
| Africa                  | 20.9                      | 24.9  |
| Asia, Far East          | 39.1                      | 157.7 |
| Asia, Middle East       | 66.2                      | 101.2 |
| Brazil                  | 107.5                     | 149.2 |
| Canada                  | 560.0                     | 620.9 |
| Central & South America | 133.6                     | 169.7 |
| China                   | 10.2                      | 46.2  |
| Europe, East            | 370.0                     | 363.9 |
| Europe, West            | 528.8                     | 583.3 |
| India                   | 8.3                       | 14.4  |
| Indonesia               | 13.7                      | 35.9  |
| Pacific                 | 513.9                     | 560.9 |

**Sources:**

Population – (2009) U.S. Census Bureau, Population Division, International Data Base (IDB) World, May 6, 2011.

(Additional resources: <http://www.census.gov/ipc/www/idb/>)

Vehicles – (2009) U.S.: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2009*, Washington, DC, 2011. All others: Ward's Communications, Ward's Motor Vehicle Data 2010, pp. 271–274. (Additional resources: [www.fhwa.dot.gov](http://www.fhwa.dot.gov), [www.wardsauto.com](http://www.wardsauto.com))



*The number of vehicles per thousand people in the United States has grown significantly from 1900 to 2009. In 2008 to 2009, however, the number decreased from a high of 843.57 in 2007.*

**Table 3.5**  
**Vehicles per Thousand People in the United States, 1990-2009**

| Year | U.S.<br>vehicles<br>per 1,000<br>people | Year | U.S.<br>vehicles<br>per 1,000<br>people | Year | U.S.<br>vehicles<br>per 1,000<br>people | Year | U.S.<br>vehicles<br>per 1,000<br>people | Year | U.S.<br>vehicles<br>per 1,000<br>people |
|------|---|------|---|------|---|------|---|------|---|
| 1900 | 0.11                                    | 1922 | 111.53                                  | 1944 | 220.23                                  | 1966 | 489.34                                  | 1988 | 772.92                                  |
| 1901 | 0.19                                    | 1923 | 134.90                                  | 1945 | 221.80                                  | 1967 | 500.66                                  | 1989 | 776.99                                  |
| 1902 | 0.29                                    | 1924 | 154.35                                  | 1946 | 243.11                                  | 1968 | 516.49                                  | 1990 | 773.40                                  |
| 1903 | 0.41                                    | 1925 | 173.26                                  | 1947 | 262.56                                  | 1969 | 533.37                                  | 1991 | 760.19                                  |
| 1904 | 0.67                                    | 1926 | 189.10                                  | 1948 | 280.20                                  | 1970 | 545.35                                  | 1992 | 757.96                                  |
| 1905 | 0.94                                    | 1927 | 195.77                                  | 1949 | 299.56                                  | 1971 | 562.45                                  | 1993 | 761.94                                  |
| 1906 | 1.27                                    | 1928 | 204.87                                  | 1950 | 323.71                                  | 1972 | 585.60                                  | 1994 | 766.94                                  |
| 1907 | 1.65                                    | 1929 | 219.31                                  | 1951 | 337.14                                  | 1973 | 615.19                                  | 1995 | 770.99                                  |
| 1908 | 2.24                                    | 1930 | 217.34                                  | 1952 | 340.57                                  | 1974 | 632.32                                  | 1996 | 781.16                                  |
| 1909 | 3.45                                    | 1931 | 210.37                                  | 1953 | 353.67                                  | 1975 | 640.07                                  | 1997 | 776.02                                  |
| 1910 | 5.07                                    | 1932 | 195.38                                  | 1954 | 361.40                                  | 1976 | 659.47                                  | 1998 | 781.20                                  |
| 1911 | 6.81                                    | 1933 | 192.38                                  | 1955 | 379.77                                  | 1977 | 669.03                                  | 1999 | 790.07                                  |
| 1912 | 9.90                                    | 1934 | 199.90                                  | 1956 | 387.58                                  | 1978 | 690.17                                  | 2000 | 800.30                                  |
| 1913 | 12.94                                   | 1935 | 208.61                                  | 1957 | 392.11                                  | 1979 | 700.42                                  | 2001 | 825.49                                  |
| 1914 | 17.79                                   | 1936 | 222.62                                  | 1958 | 392.17                                  | 1980 | 710.71                                  | 2002 | 815.22                                  |
| 1915 | 24.77                                   | 1937 | 233.33                                  | 1959 | 402.83                                  | 1981 | 715.22                                  | 2003 | 815.50                                  |
| 1916 | 35.48                                   | 1938 | 229.65                                  | 1960 | 410.37                                  | 1982 | 713.95                                  | 2004 | 829.26                                  |
| 1917 | 49.57                                   | 1939 | 236.93                                  | 1961 | 415.11                                  | 1983 | 724.30                                  | 2005 | 836.58                                  |
| 1918 | 59.69                                   | 1940 | 245.63                                  | 1962 | 426.06                                  | 1984 | 728.20                                  | 2006 | 840.09                                  |
| 1919 | 72.50                                   | 1941 | 261.57                                  | 1963 | 438.75                                  | 1985 | 744.50                                  | 2007 | 843.57                                  |
| 1920 | 86.78                                   | 1942 | 244.73                                  | 1964 | 451.57                                  | 1986 | 753.33                                  | 2008 | 840.80                                  |
| 1921 | 96.68                                   | 1943 | 225.89                                  | 1965 | 466.90                                  | 1987 | 758.58                                  | 2009 | 828.04                                  |

**Sources:**

Population – (2009) U.S. Census Bureau, Population Division, International Data Base (IDB) World, May 5, 2011.  
(Additional resources: <http://www.census.gov/ipc/www/idb/>)

Vehicles – (2008) U.S.: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2009*, Washington, DC, 2011. All others: Ward's Communications, Ward's Motor Vehicle Data 2009, pp. 257–260. (Additional resources: [www.fhwa.dot.gov](http://www.fhwa.dot.gov), [www.wardsauto.com](http://www.wardsauto.com))



*Total vehicle-miles traveled decreased slightly from 2008 to 2009. The trend of using two-axle, four-tire trucks, such as pickups, vans, and sport-utility vehicles, for personal travel is evident in these data; two-axle, four-tire trucks account for 25.3% more travel in 2009 than in 1970, and cars account for 29.9% less travel in that time period.*

**Table 3.6**  
**Shares of Highway Vehicle-Miles Traveled by Vehicle Type, 1970–2009**

| Year                                    | Cars  | Motorcycles | Two-<br>axle, four-<br>tire trucks | Other<br>single-unit<br>trucks | Combination<br>trucks | Buses | Total<br>vehicle-miles<br>traveled<br>(million miles) |
|---|-------|-------------|------------------------------------|--------------------------------|-----------------------|-------|---|
| 1970                                    | 82.6% | 0.3%        | 11.1%                              | 2.4%                           | 3.2%                  | 0.4%  | 1,109,724   |
| 1975                                    | 77.9% | 0.4%        | 15.1%                              | 2.6%                           | 3.5%                  | 0.5%  | 1,327,664   |
| 1976                                    | 76.9% | 0.4%        | 16.1%                              | 2.6%                           | 3.5%                  | 0.4%  | 1,402,380   |
| 1977                                    | 75.6% | 0.4%        | 17.1%                              | 2.7%                           | 3.8%                  | 0.4%  | 1,467,027   |
| 1978                                    | 74.2% | 0.5%        | 18.1%                              | 2.8%                           | 4.1%                  | 0.4%  | 1,544,704   |
| 1979                                    | 72.8% | 0.6%        | 19.1%                              | 2.7%                           | 4.4%                  | 0.4%  | 1,529,133   |
| 1980                                    | 72.8% | 0.7%        | 19.0%                              | 2.6%                           | 4.5%                  | 0.4%  | 1,527,295   |
| 1981                                    | 72.9% | 0.7%        | 19.1%                              | 2.5%                           | 4.4%                  | 0.4%  | 1,555,308   |
| 1982                                    | 72.8% | 0.6%        | 19.2%                              | 2.5%                           | 4.4%                  | 0.4%  | 1,595,010   |
| 1983                                    | 72.3% | 0.5%        | 19.8%                              | 2.6%                           | 4.5%                  | 0.3%  | 1,652,788   |
| 1984                                    | 71.3% | 0.5%        | 20.8%                              | 2.6%                           | 4.5%                  | 0.3%  | 1,720,269   |
| 1985                                    | 70.2% | 0.5%        | 22.0%                              | 2.6%                           | 4.4%                  | 0.3%  | 1,774,826   |
| 1986                                    | 69.2% | 0.5%        | 23.1%                              | 2.5%                           | 4.4%                  | 0.3%  | 1,834,872   |
| 1987                                    | 68.5% | 0.5%        | 23.8%                              | 2.5%                           | 4.5%                  | 0.3%  | 1,921,204   |
| 1988                                    | 67.6% | 0.5%        | 24.8%                              | 2.4%                           | 4.4%                  | 0.3%  | 2,025,962   |
| 1989                                    | 66.8% | 0.5%        | 25.6%                              | 2.4%                           | 4.4%                  | 0.3%  | 2,096,487   |
| 1990                                    | 65.7% | 0.4%        | 26.8%                              | 2.4%                           | 4.4%                  | 0.3%  | 2,144,362   |
| 1991                                    | 62.5% | 0.4%        | 29.9%                              | 2.4%                           | 4.4%                  | 0.3%  | 2,172,050   |
| 1992                                    | 61.0% | 0.4%        | 31.5%                              | 2.4%                           | 4.4%                  | 0.3%  | 2,247,151   |
| 1993                                    | 59.9% | 0.4%        | 32.5%                              | 2.5%                           | 4.5%                  | 0.3%  | 2,296,378   |
| 1994                                    | 59.6% | 0.4%        | 32.4%                              | 2.6%                           | 4.6%                  | 0.3%  | 2,357,588   |
| 1995                                    | 59.4% | 0.4%        | 32.6%                              | 2.6%                           | 4.8%                  | 0.3%  | 2,422,696   |
| 1996                                    | 59.1% | 0.4%        | 32.8%                              | 2.6%                           | 4.8%                  | 0.3%  | 2,485,848   |
| 1997                                    | 58.7% | 0.4%        | 33.2%                              | 2.6%                           | 4.9%                  | 0.3%  | 2,561,695   |
| 1998                                    | 58.9% | 0.4%        | 33.0%                              | 2.6%                           | 4.9%                  | 0.3%  | 2,631,522   |
| 1999                                    | 58.3% | 0.4%        | 33.5%                              | 2.6%                           | 4.9%                  | 0.3%  | 2,691,056   |
| 2000                                    | 58.3% | 0.4%        | 33.6%                              | 2.6%                           | 4.9%                  | 0.3%  | 2,746,925   |
| 2001                                    | 58.4% | 0.3%        | 33.6%                              | 2.6%                           | 4.9%                  | 0.3%  | 2,790,372   |
| 2002                                    | 58.1% | 0.3%        | 33.8%                              | 2.7%                           | 4.9%                  | 0.2%  | 2,855,508   |
| 2003                                    | 57.8% | 0.3%        | 34.0%                              | 2.8%                           | 4.8%                  | 0.2%  | 2,890,450   |
| 2004                                    | 57.3% | 0.3%        | 34.6%                              | 2.6%                           | 4.8%                  | 0.2%  | 2,964,788   |
| 2005                                    | 57.1% | 0.3%        | 34.8%                              | 2.6%                           | 4.8%                  | 0.2%  | 2,989,430   |
| 2006                                    | 56.1% | 0.4%        | 35.9%                              | 2.7%                           | 4.7%                  | 0.2%  | 3,014,369   |
| 2007                                    | 53.3% | 0.7%        | 35.5%                              | 4.0%                           | 6.1%                  | 0.5%  | 3,031,124   |
| 2008                                    | 52.4% | 0.7%        | 36.0%                              | 4.3%                           | 6.2%                  | 0.5%  | 2,976,528   |
| 2009                                    | 52.7% | 0.7%        | 36.4%                              | 4.1%                           | 5.7%                  | 0.5%  | 2,953,501   |
| <i>Average annual percentage change</i> |       |             |                                    |                                |                       |       |   |
| 1970–2009                               |       |             |                                    |                                |                       |       | 2.5%  |
| 1999–2009                               |       |             |                                    |                                |                       |       | 0.9%  |

**Source:**

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2009*, Washington, DC, 2011, Table VM-1 and annual. (Additional resources: [www.fhwa.dot.gov](http://www.fhwa.dot.gov))

**Note:** Due to FHWA methodology changes, data from 2007-on are not comparable with previous data.





*Due to data restrictions, the 2001 data are the latest than can be published.*

**Table 3.7**  
**Cars in Operation and Vehicle Travel by Age, 1970 and 2001**

| Age (years)          | 1970                 |               |                       | 2001                 |               |                       | 2001 Estimated vehicle travel |                       | Average annual miles per vehicle |
|----------------------|----------------------|---------------|-----------------------|----------------------|---------------|-----------------------|-------------------------------|-----------------------|----------------------------------|
|                      | Vehicles (thousands) | Percentage    | Cumulative percentage | Vehicles (thousands) | Percentage    | Cumulative percentage | Percentage                    | Cumulative percentage |                                  |
| Under 1 <sup>a</sup> | 6,288                | 7.8%          | 7.8%                  | 6,183                | 4.8%          | 4.8%                  | 6.9%                          | 6.9%                  | 15,000                           |
| 1                    | 9,299                | 11.6%         | 19.4%                 | 8,882                | 6.9%          | 11.7%                 | 9.4%                          | 16.3%                 | 14,300                           |
| 2                    | 8,816                | 11.0%         | 30.3%                 | 8,093                | 6.3%          | 18.0%                 | 8.2%                          | 24.6%                 | 13,700                           |
| 3                    | 7,878                | 9.8%          | 40.1%                 | 7,555                | 5.9%          | 23.9%                 | 7.2%                          | 31.8%                 | 12,900                           |
| 4                    | 8,538                | 10.6%         | 50.8%                 | 7,860                | 6.1%          | 30.0%                 | 7.2%                          | 39.1%                 | 12,400                           |
| 5                    | 8,506                | 10.6%         | 61.3%                 | 7,337                | 5.7%          | 35.7%                 | 6.5%                          | 45.6%                 | 12,000                           |
| 6                    | 7,116                | 8.8%          | 70.2%                 | 8,555                | 6.6%          | 42.3%                 | 7.4%                          | 53.1%                 | 11,700                           |
| 7                    | 6,268                | 7.8%          | 78.0%                 | 7,471                | 5.8%          | 48.1%                 | 6.3%                          | 59.4%                 | 11,400                           |
| 8                    | 5,058                | 6.3%          | 84.3%                 | 7,420                | 5.8%          | 53.9%                 | 6.1%                          | 65.5%                 | 11,100                           |
| 9                    | 3,267                | 4.1%          | 88.3%                 | 6,807                | 5.3%          | 59.2%                 | 5.4%                          | 71.0%                 | 10,700                           |
| 10                   | 2,776                | 3.5%          | 91.8%                 | 6,810                | 5.3%          | 64.5%                 | 5.0%                          | 76.0%                 | 9,900                            |
| 11                   | 1,692                | 2.1%          | 93.9%                 | 6,692                | 5.2%          | 69.7%                 | 4.5%                          | 80.5%                 | 9,000                            |
| 12                   | 799                  | 1.0%          | 94.9%                 | 6,742                | 5.2%          | 74.9%                 | 4.7%                          | 85.2%                 | 9,400                            |
| 13                   | 996                  | 1.2%          | 96.1%                 | 6,189                | 4.8%          | 79.7%                 | 3.8%                          | 88.9%                 | 8,200                            |
| 14                   | 794                  | 1.0%          | 97.1%                 | 5,345                | 4.2%          | 83.9%                 | 2.9%                          | 91.8%                 | 7,200                            |
| 15 and older         | 2,336                | 2.9%          | 100.0%                | 20,773               | 16.1%         | 100.0%                | 8.2%                          | 100.0%                | 5,300                            |
| <b>Subtotal</b>      | <b>80,427</b>        | <b>100.0%</b> |                       | <b>128,714</b>       | <b>100.0%</b> |                       | <b>100.0%</b>                 |                       |                                  |
| Age not given        | <b>22</b>            |               |                       | <b>0</b>             |               |                       |                               |                       |                                  |
| <b>Total</b>         | <b>80,449</b>        |               |                       | <b>128,714</b>       |               |                       |                               |                       |                                  |
| Average age          |                      |               | 5.6                   |                      |               | 9.3                   |                               |                       |                                  |
| Median age           |                      |               | 4.9                   |                      |               | 8.1                   |                               |                       |                                  |

**Source:**

The Polk Company, Detroit, MI. **FURTHER REPRODUCTION PROHIBITED.**

Vehicle travel - Average annual miles per auto by age were multiplied by the number of vehicles in operation by age to estimate the vehicle travel. Average annual miles per auto by age - generated by ORNL from the National Household Travel Survey Web site: [nhts.ornl.gov](http://nhts.ornl.gov). (Additional resources: [www.polk.com](http://www.polk.com), [nhts.ornl.gov](http://nhts.ornl.gov))

<sup>a</sup> Includes cars from model year 2002 and 2001 which were sold prior to July 1, 2002, and similarly, model years 1971 and 1970 sold prior to July 1, 1970.



Due to data restrictions, the 2001 data are the latest than can be published.

**Table 3.8**  
**Trucks in Operation and Vehicle Travel by Age, 1970 and 2001**

| Age (years)          | 1970                 |               |                       | 2001                 |               |                       | 2001 Estimated vehicle travel |                       | Average annual miles per vehicle |
|----------------------|----------------------|---------------|-----------------------|----------------------|---------------|-----------------------|-------------------------------|-----------------------|----------------------------------|
|                      | Vehicles (thousands) | Percentage    | Cumulative percentage | Vehicles (thousands) | Percentage    | Cumulative percentage | Percentage                    | Cumulative percentage |                                  |
| Under 1 <sup>a</sup> | 1,262                | 7.1%          | 7.1%                  | 6,213                | 7.1%          | 7.1%                  | 8.5%                          | 8.5%                  | 17,500                           |
| 1                    | 1,881                | 10.6%         | 17.8%                 | 7,958                | 9.0%          | 16.1%                 | 12.0%                         | 20.6%                 | 19,200                           |
| 2                    | 1,536                | 8.7%          | 26.5%                 | 7,522                | 8.6%          | 24.7%                 | 11.7%                         | 32.3%                 | 19,800                           |
| 3                    | 1,428                | 8.1%          | 34.6%                 | 6,398                | 7.3%          | 31.9%                 | 9.0%                          | 41.3%                 | 17,900                           |
| 4                    | 1,483                | 8.4%          | 43.0%                 | 6,109                | 6.9%          | 38.9%                 | 8.4%                          | 49.7%                 | 17,500                           |
| 5                    | 1,339                | 7.6%          | 50.5%                 | 5,122                | 5.8%          | 44.7%                 | 6.8%                          | 56.6%                 | 17,000                           |
| 6                    | 1,154                | 6.5%          | 57.1%                 | 5,574                | 6.3%          | 51.0%                 | 6.8%                          | 63.4%                 | 15,600                           |
| 7                    | 975                  | 5.5%          | 62.6%                 | 5,042                | 5.7%          | 56.8%                 | 6.1%                          | 69.5%                 | 15,400                           |
| 8                    | 826                  | 4.7%          | 67.3%                 | 4,148                | 4.7%          | 61.5%                 | 4.9%                          | 74.4%                 | 15,100                           |
| 9                    | 621                  | 3.5%          | 70.8%                 | 3,395                | 3.9%          | 65.3%                 | 3.5%                          | 77.9%                 | 13,200                           |
| 10                   | 658                  | 3.7%          | 74.5%                 | 3,221                | 3.7%          | 69.0%                 | 2.3%                          | 80.3%                 | 9,200                            |
| 11                   | 583                  | 3.3%          | 77.8%                 | 3,039                | 3.5%          | 72.5%                 | 2.2%                          | 82.5%                 | 9,200                            |
| 12                   | 383                  | 2.2%          | 80.0%                 | 3,345                | 3.8%          | 76.3%                 | 2.4%                          | 84.9%                 | 9,200                            |
| 13                   | 417                  | 2.4%          | 82.3%                 | 3,112                | 3.5%          | 79.8%                 | 2.3%                          | 89.1%                 | 9,200                            |
| 14                   | 414                  | 2.3%          | 84.7%                 | 2,544                | 2.9%          | 82.7%                 | 1.8%                          | 89.0%                 | 9,200                            |
| 15 and older         | 2,710                | 15.3%         | 100.0%                | 15,227               | 17.3%         | 100.0%                | 11.0%                         | 100.0%                | 9,200                            |
| <b>Subtotal</b>      | <b>17,670</b>        | <b>100.0%</b> |                       | <b>87,969</b>        | <b>100.0%</b> |                       | <b>100.0%</b>                 |                       |                                  |
| Age not given        | <b>15</b>            |               |                       | <b>0</b>             |               |                       |                               |                       |                                  |
| <b>Total</b>         | <b>17,685</b>        |               |                       | <b>87,969</b>        |               |                       |                               |                       |                                  |
| Average age          |                      | 7.3           |                       |                      | 7.9           |                       |                               |                       |                                  |
| Median age           |                      | 5.9           |                       |                      | 6.8           |                       |                               |                       |                                  |

**Source:**

The Polk Company, Detroit, MI. **FURTHER REPRODUCTION PROHIBITED.**

Vehicle travel—The average annual vehicle-miles per truck by age were multiplied by the number of trucks in operation by age to estimate the vehicle travel. Average annual miles per truck by age were generated by ORNL from the *1997 Truck Inventory and Use Survey* public use tape provided by U.S. Department of Commerce, Bureau of the Census, Washington, DC, 2000. (Additional resources: [www.polk.com](http://www.polk.com), [www.census.gov](http://www.census.gov))

<sup>a</sup> Includes trucks from model year 2002 and 2001 which were sold prior to July 1, 2002, and similarly, model years 1971 and 1970 sold prior to July 1, 1970.



**Table 3.9**  
**U.S. Average Vehicle Age, 1995-2009**

|      | Passenger Cars | Light Trucks | All Light Vehicles |
|------|----------------|--------------|--------------------|
| 1995 | 8.4            | 8.3          | 8.4                |
| 1996 | 8.5            | 8.3          | 8.5                |
| 1997 | 8.7            | 8.5          | 8.6                |
| 1998 | 8.9            | 8.5          | 8.8                |
| 1999 | 9.1            | 8.5          | 8.8                |
| 2000 | 9.1            | 8.4          | 8.9                |
| 2001 | 9.3            | 8.4          | 8.9                |
| 2002 | 9.4            | 8.4          | 9.0                |
| 2003 | 9.6            | 8.5          | 9.1                |
| 2004 | 9.8            | 8.6          | 9.4                |
| 2005 | 10.1           | 8.7          | 9.5                |
| 2006 | 10.3           | 8.9          | 9.7                |
| 2007 | 10.4           | 9.0          | 9.8                |
| 2008 | 10.6           | 9.3          | 10.0               |
| 2009 | 10.6           | 9.6          | 10.2               |

**Source:**

The Polk Company, Detroit, MI. **FURTHER REPRODUCTION PROHIBITED.** (Additional resources: [www.polk.com](http://www.polk.com))



**Table 3.10**  
**New Retail Vehicle Sales, 1970–2010**  
 (thousands)

| Calendar Year                           | Cars   | Light Trucks | Subtotal Light Vehicles | Heavy Trucks | Total Vehicle Sales |
|---|--------|--------------|-------------------------|--------------|---------------------|
| 1970                                    | 8,400  | 1,463        | 9,863                   | 334          | 10,197              |
| 1971                                    | 10,242 | 1,757        | 11,999                  | 340          | 12,339              |
| 1972                                    | 10,940 | 2,239        | 13,179                  | 438          | 13,617              |
| 1973                                    | 11,424 | 2,745        | 14,169                  | 497          | 14,666              |
| 1974                                    | 8,853  | 2,338        | 11,191                  | 424          | 11,615              |
| 1975                                    | 8,624  | 2,281        | 10,905                  | 298          | 11,203              |
| 1976                                    | 10,110 | 2,956        | 13,066                  | 324          | 13,390              |
| 1977                                    | 11,183 | 3,430        | 14,613                  | 376          | 14,989              |
| 1978                                    | 11,314 | 3,808        | 15,122                  | 441          | 15,563              |
| 1979                                    | 10,673 | 3,311        | 13,984                  | 391          | 14,375              |
| 1980                                    | 8,949  | 2,230        | 11,179                  | 265          | 11,444              |
| 1981                                    | 8,489  | 2,054        | 10,543                  | 235          | 10,778              |
| 1982                                    | 7,956  | 2,399        | 10,355                  | 183          | 10,538              |
| 1983                                    | 9,148  | 2,974        | 12,122                  | 189          | 12,311              |
| 1984                                    | 10,324 | 3,883        | 14,207                  | 277          | 14,484              |
| 1985                                    | 10,979 | 4,461        | 15,440                  | 285          | 15,725              |
| 1986                                    | 11,404 | 4,654        | 16,058                  | 265          | 16,323              |
| 1987                                    | 10,192 | 4,714        | 14,906                  | 287          | 15,193              |
| 1988                                    | 10,547 | 4,910        | 15,457                  | 334          | 15,791              |
| 1989                                    | 9,779  | 4,755        | 14,534                  | 312          | 14,846              |
| 1990                                    | 9,303  | 4,569        | 13,872                  | 277          | 14,149              |
| 1991                                    | 8,185  | 4,144        | 12,329                  | 221          | 12,550              |
| 1992                                    | 8,213  | 4,655        | 12,868                  | 249          | 13,117              |
| 1993                                    | 8,518  | 5,378        | 13,896                  | 303          | 14,199              |
| 1994                                    | 8,991  | 6,068        | 15,059                  | 353          | 15,412              |
| 1995                                    | 8,620  | 6,108        | 14,728                  | 388          | 15,116              |
| 1996                                    | 8,479  | 6,619        | 15,098                  | 359          | 15,457              |
| 1997                                    | 8,217  | 6,904        | 15,121                  | 376          | 15,497              |
| 1998                                    | 8,085  | 7,458        | 15,543                  | 424          | 15,967              |
| 1999                                    | 8,638  | 8,256        | 16,894                  | 521          | 17,415              |
| 2000                                    | 8,778  | 8,572        | 17,350                  | 462          | 17,812              |
| 2001                                    | 8,352  | 8,700        | 17,052                  | 350          | 17,402              |
| 2002                                    | 8,042  | 8,774        | 16,816                  | 322          | 17,138              |
| 2003                                    | 7,556  | 9,084        | 16,640                  | 328          | 16,968              |
| 2004                                    | 7,483  | 9,384        | 16,867                  | 432          | 17,299              |
| 2005                                    | 7,660  | 9,288        | 16,948                  | 497          | 17,445              |
| 2006                                    | 7,762  | 8,743        | 16,505                  | 545          | 17,050              |
| 2007                                    | 7,562  | 8,527        | 16,089                  | 371          | 16,460              |
| 2008                                    | 6,769  | 6,426        | 13,195                  | 298          | 13,493              |
| 2009                                    | 5,401  | 5,001        | 10,402                  | 200          | 10,602              |
| 2010                                    | 5,635  | 5,919        | 11,554                  | 218          | 11,772              |
| <i>Average annual percentage change</i> |        |              |                         |              |                     |
| 1970-2010                               | -1.0%  | 3.6%         | 0.4%                    | -1.1%        | 0.4%                |
| 2000-2010                               | -4.3%  | -3.9%        | -4.0%                   | -7.2%        | -4.1%               |

**Source:**1970-2010: Ward's Communications, [www.wardsauto.com](http://www.wardsauto.com).

Using current registration data and a scrappage model by Greenspan and Cohen, [1996 paper: <http://www.federalreserve.gov/pubs/feds/1996/199640/199640pap.pdf>], ORNL calculated new automobile scrappage rates. The expected median lifetime for a 1990 model year automobile is 16.9 years. These data are fitted model values which assume constant economic conditions.

**Table 3.11**  
**Car Scrappage and Survival Rates**  
**1970, 1980 and 1990 Model Years**

| Vehicle age <sup>a</sup><br>(years) | 1970 Model Year            |                             | 1980 Model Year            |                             | 1990 Model Year            |                             |
|-------------------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|
|                                     | Survival rate <sup>b</sup> | Scrappage rate <sup>c</sup> | Survival rate <sup>b</sup> | Scrappage rate <sup>c</sup> | Survival rate <sup>b</sup> | Scrappage rate <sup>c</sup> |
| 4                                   | 99.0                       | 1.0                         | 100.0                      | 0.0                         | 100.0                      | 0.0                         |
| 5                                   | 94.1                       | 5.0                         | 96.3                       | 3.7                         | 100.0                      | 0.0                         |
| 6                                   | 88.4                       | 6.1                         | 91.3                       | 5.1                         | 99.4                       | 0.6                         |
| 7                                   | 82.0                       | 7.2                         | 85.7                       | 6.1                         | 96.3                       | 3.2                         |
| 8                                   | 75.2                       | 8.3                         | 79.7                       | 7.1                         | 92.7                       | 3.7                         |
| 9                                   | 68.1                       | 9.5                         | 73.3                       | 8.1                         | 88.7                       | 4.3                         |
| 10                                  | 60.9                       | 10.6                        | 66.6                       | 9.0                         | 84.4                       | 4.9                         |
| 11                                  | 53.8                       | 11.7                        | 60.0                       | 10.0                        | 79.8                       | 5.5                         |
| 12                                  | 46.9                       | 12.8                        | 53.3                       | 11.0                        | 75.0                       | 6.1                         |
| 13                                  | 40.3                       | 14.0                        | 46.9                       | 12.0                        | 70.0                       | 6.7                         |
| 14                                  | 34.2                       | 15.1                        | 40.8                       | 13.0                        | 64.9                       | 7.3                         |
| 15                                  | 28.7                       | 16.2                        | 35.1                       | 14.0                        | 59.7                       | 7.9                         |
| 16                                  | 23.7                       | 17.4                        | 29.8                       | 15.0                        | 54.6                       | 8.6                         |
| 17                                  | 19.3                       | 18.5                        | 25.0                       | 16.1                        | 49.5                       | 9.3                         |
| 18                                  | 15.5                       | 19.6                        | 20.8                       | 17.1                        | 44.6                       | 9.9                         |
| 19                                  | 12.3                       | 20.8                        | 17.0                       | 18.1                        | 39.9                       | 10.6                        |
| 20                                  | 9.6                        | 21.9                        | 13.8                       | 19.1                        | 35.4                       | 11.3                        |
| 21                                  | 7.4                        | 23.0                        | 11.0                       | 20.1                        | 31.1                       | 12.0                        |
| 22                                  | 5.6                        | 24.2                        | 8.7                        | 21.2                        | 27.2                       | 12.7                        |
| 23                                  | 4.2                        | 25.3                        | 6.7                        | 22.2                        | 23.5                       | 13.5                        |
| 24                                  | 3.1                        | 26.4                        | 5.2                        | 23.2                        | 20.2                       | 14.2                        |
| 25                                  | 2.2                        | 27.5                        | 3.9                        | 24.2                        | 17.1                       | 15.0                        |
| 26                                  | 1.6                        | 28.6                        | 2.9                        | 25.3                        | 14.5                       | 15.7                        |
| 27                                  | 1.1                        | 29.7                        | 2.2                        | 26.3                        | 12.1                       | 16.5                        |
| 28                                  | 0.8                        | 30.8                        | 1.6                        | 27.3                        | 10.0                       | 17.2                        |
| 29                                  | 0.5                        | 31.9                        | 1.1                        | 28.4                        | 8.2                        | 18.0                        |
| 30                                  | 0.4                        | 33.0                        | 0.8                        | 29.4                        | 6.6                        | 18.8                        |
| Median lifetime                     | 11.5 years                 |                             | 12.5 years                 |                             | 16.9 years                 |                             |

**Source:**

Schmoyer, Richard L., unpublished study on scrappage rates, Oak Ridge National Laboratory, Oak Ridge, TN, 2001.

<sup>a</sup> It was assumed that scrappage for vehicles less than 4 years old is 0.

<sup>b</sup> The percentage of automobiles which will be in use at the end of the year.

<sup>c</sup> The percentage of automobiles which will be retired from use during the year.



Using current registration data and a scrappage model by Greenspan and Cohen [1996 paper: <http://www.federalreserve.gov/pubs/feds/1996/199640/199640pap.pdf>], ORNL calculated new light truck scrappage rates. The expected median lifetime for a 1990 model year light truck is 15.5 years. These data are fitted model values which assume constant economic conditions.

**Table 3.12**  
**Light Truck<sup>a</sup> Scrappage and Survival Rates**

| Vehicle age <sup>b</sup><br>(years) | 1970 model year            |                             | 1980 model year            |                             | 1990 model year            |                             |
|-------------------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|
|                                     | Survival rate <sup>b</sup> | Scrappage rate <sup>c</sup> | Survival rate <sup>b</sup> | Scrappage rate <sup>d</sup> | Survival rate <sup>b</sup> | Scrappage rate <sup>c</sup> |
| 4                                   | 99.7                       | 0.3                         | 99.1                       | 0.9                         | 99.3                       | 0.7                         |
| 5                                   | 97.5                       | 2.2                         | 96.6                       | 2.5                         | 96.9                       | 2.4                         |
| 6                                   | 94.9                       | 2.7                         | 93.7                       | 3.1                         | 94.1                       | 3.0                         |
| 7                                   | 91.8                       | 3.2                         | 90.2                       | 3.7                         | 90.7                       | 3.6                         |
| 8                                   | 88.3                       | 3.8                         | 86.3                       | 4.3                         | 86.9                       | 4.2                         |
| 9                                   | 84.4                       | 4.4                         | 82.0                       | 5.0                         | 82.7                       | 4.8                         |
| 10                                  | 80.2                       | 5.0                         | 77.3                       | 5.7                         | 78.2                       | 5.5                         |
| 11                                  | 75.7                       | 5.6                         | 72.4                       | 6.4                         | 73.4                       | 6.1                         |
| 12                                  | 70.9                       | 6.3                         | 67.3                       | 7.1                         | 68.4                       | 6.8                         |
| 13                                  | 66.0                       | 6.9                         | 62.1                       | 7.8                         | 63.3                       | 7.5                         |
| 14                                  | 61.0                       | 7.6                         | 56.8                       | 8.5                         | 58.0                       | 8.2                         |
| 15                                  | 55.9                       | 8.3                         | 51.5                       | 9.3                         | 52.8                       | 9.0                         |
| 16                                  | 50.8                       | 9.0                         | 46.3                       | 10.1                        | 47.7                       | 9.7                         |
| 17                                  | 45.9                       | 9.8                         | 41.3                       | 10.8                        | 42.7                       | 10.5                        |
| 18                                  | 41.1                       | 10.5                        | 36.5                       | 11.6                        | 37.9                       | 11.3                        |
| 19                                  | 36.4                       | 11.3                        | 32.0                       | 12.4                        | 33.3                       | 12.1                        |
| 20                                  | 32.1                       | 12.0                        | 27.7                       | 13.3                        | 29.0                       | 12.9                        |
| 21                                  | 28.0                       | 12.8                        | 23.8                       | 14.1                        | 25.0                       | 13.7                        |
| 22                                  | 24.2                       | 13.6                        | 20.3                       | 14.9                        | 21.4                       | 14.5                        |
| 23                                  | 20.7                       | 14.4                        | 17.1                       | 15.8                        | 18.1                       | 15.4                        |
| 24                                  | 17.5                       | 15.2                        | 14.2                       | 16.7                        | 15.2                       | 16.2                        |
| 25                                  | 14.7                       | 16.1                        | 11.7                       | 17.5                        | 12.6                       | 17.1                        |
| 26                                  | 12.2                       | 16.9                        | 9.6                        | 18.4                        | 10.3                       | 18.0                        |
| 27                                  | 10.1                       | 17.8                        | 7.7                        | 19.3                        | 8.4                        | 18.8                        |
| 28                                  | 8.2                        | 18.6                        | 6.2                        | 20.2                        | 6.7                        | 19.7                        |
| 29                                  | 6.6                        | 19.5                        | 4.9                        | 21.1                        | 5.3                        | 20.6                        |
| 30                                  | 5.2                        | 20.4                        | 3.8                        | 22.1                        | 4.2                        | 21.5                        |
| Median lifetime                     | 16.2 years                 |                             | 15.3 years                 |                             | 15.5 years                 |                             |

**Source:**

Schmoyer, Richard L., unpublished study on scrappage rates, Oak Ridge National Laboratory, Oak Ridge, TN, 2001.

<sup>a</sup> Light trucks are trucks less than 10,000 lbs. gross vehicle weight.

<sup>b</sup> It was assumed that scrappage for vehicles less than 4 years old is 0.

<sup>c</sup> The percentage of light trucks which will be retired from use during the year.

<sup>d</sup> The percentage of light trucks which will be in use at the end of the year.



Using current registration data and a scrappage model by Greenspan and Cohen [1996 paper: <http://www.federalreserve.gov/pubs/feds/1996/199640/199640pap.pdf>], ORNL calculated heavy truck (trucks over 26,000 lbs. gross vehicle weight) scrappage rates. The expected median lifetime for a 1990 model year heavy truck is 29 years. These data are fitted model values which assume constant economic conditions.

**Table 3.13**  
**Heavy Truck<sup>a</sup> Scrappage and Survival Rates**

| Vehicle age <sup>b</sup><br>(years) | 1970 model year            |                             | 1980 model year            |                             | 1990 model year            |                             |
|-------------------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|
|                                     | Survival rate <sup>c</sup> | Scrappage rate <sup>d</sup> | Survival rate <sup>b</sup> | Scrappage rate <sup>c</sup> | Survival rate <sup>b</sup> | Scrappage rate <sup>c</sup> |
| 4                                   | 98.8                       | 1.2                         | 98.5                       | 1.5                         | 99.4                       | 0.6                         |
| 5                                   | 97.2                       | 1.6                         | 96.7                       | 1.9                         | 98.6                       | 0.8                         |
| 6                                   | 95.3                       | 1.9                         | 94.5                       | 2.3                         | 97.6                       | 1.0                         |
| 7                                   | 93.2                       | 2.3                         | 92.0                       | 2.7                         | 96.5                       | 1.2                         |
| 8                                   | 90.7                       | 2.6                         | 89.1                       | 3.1                         | 95.2                       | 1.3                         |
| 9                                   | 88.1                       | 3.0                         | 86.0                       | 3.5                         | 93.8                       | 1.5                         |
| 10                                  | 85.2                       | 3.3                         | 82.7                       | 3.9                         | 92.2                       | 1.7                         |
| 11                                  | 82.1                       | 3.6                         | 79.1                       | 4.3                         | 90.5                       | 1.9                         |
| 12                                  | 78.8                       | 4.0                         | 75.4                       | 4.7                         | 88.6                       | 2.0                         |
| 13                                  | 75.4                       | 4.3                         | 71.6                       | 5.1                         | 86.7                       | 2.2                         |
| 14                                  | 71.9                       | 4.7                         | 67.7                       | 5.5                         | 84.6                       | 2.4                         |
| 15                                  | 68.3                       | 5.0                         | 63.7                       | 5.9                         | 82.4                       | 2.6                         |
| 16                                  | 64.6                       | 5.3                         | 59.7                       | 6.3                         | 80.2                       | 2.7                         |
| 17                                  | 61.0                       | 5.7                         | 55.7                       | 6.7                         | 77.9                       | 2.9                         |
| 18                                  | 57.3                       | 6.0                         | 51.8                       | 7.1                         | 75.5                       | 3.1                         |
| 19                                  | 53.7                       | 6.3                         | 47.9                       | 7.4                         | 73.0                       | 3.3                         |
| 20                                  | 50.1                       | 6.7                         | 44.2                       | 7.8                         | 70.5                       | 3.4                         |
| 21                                  | 46.6                       | 7.0                         | 40.6                       | 8.2                         | 68.0                       | 3.6                         |
| 22                                  | 43.2                       | 7.3                         | 37.1                       | 8.6                         | 65.4                       | 3.8                         |
| 23                                  | 39.9                       | 7.6                         | 33.7                       | 9.0                         | 62.8                       | 3.9                         |
| 24                                  | 36.7                       | 8.0                         | 30.6                       | 9.4                         | 60.3                       | 4.1                         |
| 25                                  | 33.7                       | 8.3                         | 27.6                       | 9.7                         | 57.7                       | 4.3                         |
| 26                                  | 30.8                       | 8.6                         | 24.8                       | 10.1                        | 55.1                       | 4.5                         |
| 27                                  | 28.0                       | 8.9                         | 22.2                       | 10.5                        | 52.6                       | 4.6                         |
| 28                                  | 25.4                       | 9.3                         | 19.8                       | 10.9                        | 50.0                       | 4.8                         |
| 29                                  | 23.0                       | 9.6                         | 17.6                       | 11.2                        | 47.6                       | 5.0                         |
| 30                                  | 20.7                       | 9.9                         | 15.5                       | 11.6                        | 45.1                       | 5.1                         |
| Median lifetime                     | 20.0 years                 |                             | 18.5 years                 |                             | 28.0 years                 |                             |

**Source:**

Schmoyer, Richard L., unpublished study on scrappage rates, Oak Ridge National Laboratory, Oak Ridge, TN, 2001.

- <sup>a</sup> Light trucks are trucks less than 10,000 lbs. gross vehicle weight.  
<sup>b</sup> It was assumed that scrappage for vehicles less than 4 years old is 0.  
<sup>c</sup> The percentage of light trucks which will be retired from use during the year.  
<sup>d</sup> The percentage of light trucks which will be in use at the end of the year.



*A typical car will travel 152,137 miles in a lifetime, while a typical light truck will travel 179,954 miles.*

**Table 3.14**  
**Car and Light Truck Survivability Rates and Lifetime Miles**

| Vehicle age<br>(Years) | Car<br>Survivability<br>rate | Light truck<br>survivability<br>rate |
|------------------------|------------------------------|--------------------------------------|
| 1                      | 0.9900                       | 0.9741                               |
| 2                      | 0.9831                       | 0.9603                               |
| 3                      | 0.9731                       | 0.9420                               |
| 4                      | 0.9593                       | 0.9190                               |
| 5                      | 0.9413                       | 0.8913                               |
| 6                      | 0.9188                       | 0.8590                               |
| 7                      | 0.8918                       | 0.8226                               |
| 8                      | 0.8604                       | 0.7827                               |
| 9                      | 0.8252                       | 0.7401                               |
| 10                     | 0.7866                       | 0.6956                               |
| 11                     | 0.7170                       | 0.6501                               |
| 12                     | 0.6125                       | 0.6040                               |
| 13                     | 0.5094                       | 0.5517                               |
| 14                     | 0.4142                       | 0.5009                               |
| 15                     | 0.3308                       | 0.4522                               |
| 16                     | 0.2604                       | 0.4062                               |
| 17                     | 0.2028                       | 0.3633                               |
| 18                     | 0.1565                       | 0.3236                               |
| 19                     | 0.1200                       | 0.2873                               |
| 20                     | 0.0916                       | 0.2542                               |
| 21                     | 0.0696                       | 0.2244                               |
| 22                     | 0.0527                       | 0.1975                               |
| 23                     | 0.0399                       | 0.1735                               |
| 24                     | 0.0301                       | 0.1522                               |
| 25                     | 0.0227                       | 0.1332                               |
| 26                     | <sup>a</sup>                 | 0.1165                               |
| 27                     | <sup>a</sup>                 | 0.1017                               |
| 28                     | <sup>a</sup>                 | 0.0887                               |
| 29                     | <sup>a</sup>                 | 0.0773                               |
| 30                     | <sup>a</sup>                 | 0.0673                               |
| 31                     | <sup>a</sup>                 | 0.0586                               |
| 32                     | <sup>a</sup>                 | 0.0509                               |
| 33                     | <sup>a</sup>                 | 0.0443                               |
| 34                     | <sup>a</sup>                 | 0.0385                               |
| 35                     | <sup>a</sup>                 | 0.0334                               |
| 36                     | <sup>a</sup>                 | 0.0290                               |
| Lifetime miles         | 152,137                      | 179,954                              |

**Source:**

U.S. Department of Transportation, National Highway Traffic Safety Administration, *Vehicle Survivability and Travel Mileage Schedules*, January 2006.

**Note:** Registration data from 1977 to 2002 were used in developing these estimates. In this analysis, vehicle age was cut off when the estimated survival rate reached approximately a two percent threshold; for cars, this was 25 years, and for trucks it was 36 years.

<sup>a</sup> Data are not available.





## Chapter 4

### Light Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

| Source                  |   |           |
|-------------------------|---|-----------|
| Table 4.1               | Cars, 2009  |           |
|                         | <i>Registrations (thousands)</i>                  | 134,880   |
|                         | <i>Vehicle miles (million miles)</i>              | 1,606,815 |
|                         | <i>Fuel economy (miles per gallon)</i>            | 22.5      |
| Table 4.2               | Two-axle, four-tire trucks, 2009                  |           |
|                         | <i>Registrations (thousands)</i>                  | 100,154   |
|                         | <i>Vehicle miles (million miles)</i>              | 1,108,656 |
|                         | <i>Fuel economy (miles per gallon)</i>            | 18.0      |
| Table 4.6               | Light truck share of total light vehicle sales    |           |
|                         | <i>1970 calendar year</i>                         | 14.8%     |
|                         | <i>2010 calendar year</i>                         | 51.2%     |
| Table 4.7               | Car sales, 2010 model year (thousands)            | 8,020     |
|                         | <i>Small</i>                                      | 3,223     |
|                         | <i>Midsized</i>                                   | 2,979     |
|                         | <i>Large</i>                                      | 1,093     |
| Table 4.9               | Light truck sales, 2010 model year (thousands)    | 5,601     |
|                         | <i>Midsized pickup</i>                            | 196       |
|                         | <i>Large pickup</i>                               | 1,527     |
|                         | <i>Midsized van</i>                               | 450       |
|                         | <i>Large van</i>                                  | 18        |
|                         | <i>Small SUV</i>                                  | 67        |
|                         | <i>Midsized SUV</i>                               | 1,912     |
|                         | <i>Large SUV</i>                                  | 1,420     |
| Tables 4.20<br>and 4.21 | Corporate average fuel economy                    | (mpg)     |
|                         | <i>Car standard, MY 2011</i>                      | 30.2      |
|                         | <i>Car fuel economy, MY 2011</i>                  | 34.4      |
|                         | <i>Light truck standard, MY 2011 (unreformed)</i> | 24.2      |
|                         | <i>Light truck fuel economy, MY 2011</i>          | 24.8      |
| Table 4.26              | Average fuel economy loss from 55 to 70 mph       | 17.1%     |



*Car registrations, along with vehicle travel and fuel use, all declined from 2008 to 2009. The data in this table from 1985–on DO NOT include minivans, pickups, or sport utility vehicles. Much of the data for 2009 were estimated; the FHWA no longer publishes travel and fuel data for cars.*

**Table 4.1**  
**Summary Statistics for Cars, 1970–2009**

| Year                                    | Registrations <sup>a</sup><br>(thousands) | Vehicle travel (million<br>miles) | Fuel use<br>(million gallons) | Fuel economy <sup>b</sup><br>(miles per gallon) |
|---|---|-----------------------------------|-------------------------------|---|
| 1970                                    | 89,244                                    | 916,700                           | 67,820                        | 13.5  |
| 1975                                    | 106,706                                   | 1,033,950                         | 74,140                        | 13.9  |
| 1980                                    | 121,601                                   | 1,111,596                         | 69,981                        | 15.9  |
| 1981                                    | 123,098                                   | 1,133,332                         | 69,112                        | 16.4  |
| 1982                                    | 123,702                                   | 1,161,713                         | 69,116                        | 16.8  |
| 1983                                    | 126,444                                   | 1,195,054                         | 70,322                        | 17.0  |
| 1984                                    | 128,158                                   | 1,227,043                         | 70,663                        | 17.4  |
| 1985 <sup>c</sup>                       | 127,885                                   | 1,246,798                         | 71,518                        | 17.4  |
| 1986                                    | 130,004                                   | 1,270,167                         | 73,174                        | 17.4  |
| 1987                                    | 131,482                                   | 1,315,982                         | 73,308                        | 18.0  |
| 1988                                    | 133,836                                   | 1,370,271                         | 73,345                        | 18.7  |
| 1989                                    | 134,559                                   | 1,401,221                         | 73,913                        | 19.0  |
| 1990                                    | 133,700                                   | 1,408,266                         | 69,568                        | 20.2  |
| 1991                                    | 128,300                                   | 1,358,185                         | 64,318                        | 21.1  |
| 1992                                    | 126,581                                   | 1,371,569                         | 65,436                        | 21.0  |
| 1993                                    | 127,327                                   | 1,374,709                         | 67,047                        | 20.5  |
| 1994                                    | 127,883                                   | 1,406,089                         | 67,874                        | 20.7  |
| 1995                                    | 128,387                                   | 1,438,294                         | 68,072                        | 21.1  |
| 1996                                    | 129,728                                   | 1,469,854                         | 69,221                        | 21.2  |
| 1997                                    | 129,749                                   | 1,502,556                         | 69,892                        | 21.5  |
| 1998                                    | 131,839                                   | 1,549,577                         | 71,695                        | 21.6  |
| 1999                                    | 132,432                                   | 1,569,100                         | 73,283                        | 21.4  |
| 2000                                    | 133,621                                   | 1,600,287                         | 73,065                        | 21.9  |
| 2001                                    | 137,633                                   | 1,628,332                         | 73,559                        | 22.1  |
| 2002                                    | 135,921                                   | 1,658,474                         | 75,471                        | 22.0  |
| 2003                                    | 135,670                                   | 1,672,079                         | 74,590                        | 22.2  |
| 2004                                    | 136,431                                   | 1,699,890                         | 75,402                        | 22.5  |
| 2005                                    | 136,568                                   | 1,708,421                         | 77,418                        | 22.1  |
| 2006                                    | 135,400                                   | 1,690,534                         | 75,009                        | 22.5  |
| 2007                                    | 135,933                                   | 1,672,467                         | 74,377                        | 22.5  |
| 2008                                    | 137,080                                   | 1,615,850                         | 71,497                        | 22.6  |
| 2009 <sup>d</sup>                       | 134,880                                   | 1,606,815                         | 71,473                        | 22.5  |
| <i>Average annual percentage change</i> |   |                                   |                               |   |
| 1970–2009                               | 1.1%                                      | 1.4%                              | 0.1%                          | 1.3%  |
| 1999–2009                               | 0.2%                                      | 0.2%                              | -0.2%                         | 0.5%  |

**Source:**

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2009*, Washington, DC, 2011, Table VM-1 and annual. (Additional resources: [www.fhwa.dot.gov](http://www.fhwa.dot.gov))

<sup>a</sup> This number differs from R.L. Polk's estimates of "number of cars in use." See Table 3.3.

<sup>b</sup> Fuel economy for car population.

<sup>c</sup> Beginning in this year the data were revised to exclude minivans, pickups and sport utility vehicles which may have been previously included.

<sup>d</sup> Because vehicle travel, fuel use, and fuel economy are no longer published for cars, the 2009 data were estimated.



*Much of the data for 2009 were estimated; the FHWA no longer publishes travel and fuel use data for two-axle, four tire trucks.*

**Table 4.2**  
**Summary Statistics for Two-Axle, Four-Tire Trucks, 1970–2009**

| Year                                    | Registrations<br>(thousands) | Vehicle travel<br>(million miles) | Fuel use<br>(million gallons) | Fuel economy<br>(miles per gallon) |
|---|------------------------------|-----------------------------------|-------------------------------|------------------------------------|
| 1970                                    | 14,211                       | 123,286                           | 12,313                        | 10.0                               |
| 1975                                    | 20,418                       | 200,700                           | 19,081                        | 10.5                               |
| 1976                                    | 22,301                       | 225,834                           | 20,828                        | 10.8                               |
| 1977                                    | 23,624                       | 250,591                           | 22,383                        | 11.2                               |
| 1978                                    | 25,476                       | 279,414                           | 24,162                        | 11.6                               |
| 1979                                    | 27,022                       | 291,905                           | 24,445                        | 11.9                               |
| 1980                                    | 27,876                       | 290,935                           | 23,796                        | 12.2                               |
| 1981                                    | 28,928                       | 296,343                           | 23,697                        | 12.5                               |
| 1982                                    | 29,792                       | 306,141                           | 22,702                        | 13.5                               |
| 1983                                    | 31,214                       | 327,643                           | 23,945                        | 13.7                               |
| 1984                                    | 32,106                       | 358,006                           | 25,604                        | 14.0                               |
| 1985 <sup>a</sup>                       | 37,214                       | 390,961                           | 27,363                        | 14.3                               |
| 1986                                    | 39,382                       | 423,915                           | 29,074                        | 14.6                               |
| 1987                                    | 41,107                       | 456,870                           | 30,598                        | 14.9                               |
| 1988                                    | 43,805                       | 502,207                           | 32,653                        | 15.4                               |
| 1989                                    | 45,945                       | 536,475                           | 33,271                        | 16.1                               |
| 1990                                    | 48,275                       | 574,571                           | 35,611                        | 16.1                               |
| 1991                                    | 53,033                       | 649,394                           | 38,217                        | 17.0                               |
| 1992                                    | 57,091                       | 706,863                           | 40,929                        | 17.3                               |
| 1993                                    | 59,994                       | 745,750                           | 42,851                        | 17.4                               |
| 1994                                    | 62,904                       | 764,634                           | 44,112                        | 17.3                               |
| 1995                                    | 65,738                       | 790,029                           | 45,605                        | 17.3                               |
| 1996                                    | 69,134                       | 816,540                           | 47,354                        | 17.2                               |
| 1997                                    | 70,224                       | 850,739                           | 49,389                        | 17.2                               |
| 1998                                    | 71,330                       | 868,275                           | 50,462                        | 17.2                               |
| 1999                                    | 75,356                       | 901,022                           | 52,859                        | 17.0                               |
| 2000                                    | 79,085                       | 923,059                           | 52,939                        | 17.4                               |
| 2001                                    | 84,188                       | 943,207                           | 53,522                        | 17.6                               |
| 2002                                    | 85,011                       | 966,034                           | 55,220                        | 17.5                               |
| 2003                                    | 87,187                       | 984,094                           | 60,758                        | 16.2                               |
| 2004                                    | 91,845                       | 1,027,164                         | 63,417                        | 16.2                               |
| 2005                                    | 95,337                       | 1,041,051                         | 58,869                        | 17.7                               |
| 2006                                    | 99,125                       | 1,082,490                         | 60,685                        | 17.8                               |
| 2007                                    | 101,470                      | 1,112,271                         | 61,836                        | 18.0                               |
| 2008                                    | 101,235                      | 1,108,603                         | 61,199                        | 18.1                               |
| 2009 <sup>b</sup>                       | 100,154                      | 1,108,656                         | 61,610                        | 18.0                               |
| <i>Average annual percentage change</i> |                              |                                   |                               |                                    |
| 1970–2009                               | 5.1%                         | 5.8%                              | 4.2%                          | 1.5%                               |
| 1999–2009                               | 2.9%                         | 2.1%                              | 1.5%                          | 0.6%                               |

**Source:**

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2009*, Washington, DC, 2011, Table MV-9. Previous years Table VM-1. (Additional resources: [www.fhwa.dot.gov](http://www.fhwa.dot.gov))

<sup>a</sup> Beginning in this year the data were revised to include all vans (including mini-vans), pickups and sport utility vehicles.

<sup>b</sup> Because vehicle travel, fuel use, and fuel economy are no longer published for cars, the 2009 data were estimated.



*Because data on Class 2b trucks are scarce, the U.S. DOE funded a study to investigate available sources of data. In the final report, four methodologies are described to estimate the sales of Class 2b trucks. Until another study is funded, the 1999 data are the latest available.*

**Table 4.3**  
**Summary Statistics on Class 1, Class 2a, and Class 2b Light Trucks**

|          | CY 1999<br>truck sales<br>(millions) | MY 2000<br>truck<br>population<br>(millions) | Percent<br>diesel trucks<br>in<br>population | Average<br>age<br>(years) | Estimated<br>annual<br>miles <sup>a</sup><br>(billions) | Estimated<br>fuel use<br>(billion <sup>a</sup><br>gallons) | Estimated fuel<br>economy<br>(miles per<br>gallon) |
|----------|--------------------------------------|--|--|---------------------------|---|--|--|
| Class 1  | 5.7                                  | 49.7   | 0.3%   | 7.3                       | 672.7   | 37.4   | 18.0   |
| Class 2a | 1.8                                  | 19.2   | 2.5%   | 7.4                       | 251.9   | 18.0   | 14.0   |
| Class 2b | 0.5                                  | 5.8  | 24.0%  | 8.6                       | 76.7  | 5.5  | 13.9   |

**Source:**

Davis, S.C. and L.F. Truett, *Investigation of Class 2b Trucks (Vehicles of 8,500 to 10,000 lbs GVWR)*, ORNL/TM-2002/49, March 2002, Table 16.

**Note:** CY - calendar year. MY - model year.

**Table 4.4**  
**Sales Estimates of Class 1, Class 2a, and Class 2b Light Trucks, 1989–1999**

| Calendar Year         | Sales estimates (thousands)      |                               |                                | Total |
|-----------------------|----------------------------------|-------------------------------|--------------------------------|-------|
|                       | Class 1<br>(6,000 lbs and under) | Class 2a<br>(6,001-8,500 lbs) | Class 2b<br>(8,501-10,000 lbs) |       |
| 1989                  | 3,313                            | 918                           | 379                            | 4,610 |
| 1990                  | 3,451                            | 829                           | 268                            | 4,548 |
| 1991                  | 3,246                            | 670                           | 206                            | 4,122 |
| 1992                  | 3,608                            | 827                           | 194                            | 4,629 |
| 1993                  | 4,119                            | 975                           | 257                            | 5,351 |
| 1994                  | 4,527                            | 1,241                         | 265                            | 6,033 |
| 1995                  | 4,422                            | 1,304                         | 327                            | 6,053 |
| 1996                  | 4,829                            | 1,356                         | 334                            | 6,519 |
| 1997                  | 5,085                            | 1,315                         | 397                            | 6,797 |
| 1998                  | 5,263                            | 1,694                         | 342                            | 7,299 |
| 1999                  | 5,707                            | 1,845                         | 521                            | 8,073 |
| <i>Percent change</i> |                                  |                               |                                |       |
| 1989–1999             | 72.3%                            | 101.0%                        | 37.5%                          | 75.1% |

**Source:**

Davis, S.C. and L.F. Truett, *Investigation of Class 2b Trucks (Vehicles of 8,500 to 10,000 lbs GVWR)*, ORNL/TM-2002/49, March 2002, Table 1.

**Note:** These data were calculated using Methodology 4 from the report.

<sup>a</sup> Estimates derived using 2000 population data and 1997 usage data. See source for details.



Car sales in 2009 and 2010 were below 6 million. In 1980, the Big 3 (Chrysler, Ford and General Motors) held 73.8% of the market; by 2010, that had dropped to 31.8%.

**Table 4.5**  
**New Retail Car Sales in the United States, 1970–2010**

| Calendar year                           | Domestic <sup>a</sup> | Import <sup>b</sup><br>(thousands) | Total  | Percentage imports | Percentage Big 3 Sales <sup>c</sup> | Percentage diesel | Diesel Cars |
|---|-----------------------|------------------------------------|--------|--------------------|-------------------------------------|-------------------|-------------|
| 1970                                    | 7,119                 | 1,280                              | 8,400  | 15.2%              | <sup>d</sup>                        | 0.07%             | 6           |
| 1975                                    | 7,053                 | 1,571                              | 8,624  | 18.2%              | <sup>d</sup>                        | 0.31%             | 27          |
| 1980                                    | 6,580                 | 2,369                              | 8,949  | 26.5%              | 73.8%                               | 4.32%             | 387         |
| 1985                                    | 8,205                 | 2,775                              | 10,979 | 25.3%              | 72.9%                               | 0.83%             | 91          |
| 1986                                    | 8,215                 | 3,189                              | 11,404 | 28.0%              | 70.9%                               | 0.37%             | 42          |
| 1987                                    | 7,085                 | 3,107                              | 10,192 | 30.5%              | 67.6%                               | 0.17%             | 17          |
| 1988                                    | 7,543                 | 3,004                              | 10,547 | 28.5%              | 69.3%                               | 0.02%             | 2           |
| 1989                                    | 7,098                 | 2,680                              | 9,779  | 27.4%              | 67.9%                               | 0.13%             | 13          |
| 1990                                    | 6,919                 | 2,384                              | 9,303  | 25.6%              | 65.7%                               | 0.08%             | 7           |
| 1991                                    | 6,162                 | 2,023                              | 8,185  | 24.7%              | 64.2%                               | 0.10%             | 8           |
| 1992                                    | 6,286                 | 1,927                              | 8,213  | 23.5%              | 65.8%                               | 0.06%             | 5           |
| 1993                                    | 6,742                 | 1,776                              | 8,518  | 20.8%              | 67.3%                               | 0.04%             | 3           |
| 1994                                    | 7,255                 | 1,735                              | 8,991  | 19.3%              | 65.9%                               | 0.04%             | 4           |
| 1995                                    | 7,114                 | 1,506                              | 8,620  | 17.5%              | 65.3%                               | 0.03%             | 3           |
| 1996                                    | 7,206                 | 1,272                              | 8,479  | 15.0%              | 64.1%                               | 0.09%             | 8           |
| 1997                                    | 6,862                 | 1,355                              | 8,217  | 16.5%              | 62.2%                               | 0.09%             | 7           |
| 1998                                    | 6,705                 | 1,380                              | 8,085  | 17.1%              | 59.7%                               | 0.14%             | 11          |
| 1999                                    | 6,919                 | 1,719                              | 8,638  | 19.9%              | 58.3%                               | 0.16%             | 14          |
| 2000                                    | 6,762                 | 2,016                              | 8,778  | 23.0%              | 55.0%                               | 0.26%             | 23          |
| 2001                                    | 6,254                 | 2,098                              | 8,352  | 25.1%              | 51.4%                               | 0.18%             | 15          |
| 2002                                    | 5,817                 | 2,226                              | 8,042  | 27.7%              | 48.4%                               | 0.39%             | 31          |
| 2003                                    | 5,473                 | 2,083                              | 7,556  | 27.6%              | 47.1%                               | 0.52%             | 39          |
| 2004                                    | 5,334                 | 2,149                              | 7,483  | 28.7%              | 44.9%                               | 0.40%             | 30          |
| 2005                                    | 5,473                 | 2,187                              | 7,660  | 28.6%              | 43.1%                               | 0.63%             | 48          |
| 2006                                    | 5,417                 | 2,345                              | 7,762  | 30.2%              | 40.5%                               | 0.86%             | 67          |
| 2007                                    | 5,198                 | 2,365                              | 7,562  | 31.3%              | 36.9%                               | 0.11%             | 8           |
| 2008                                    | 4,490                 | 2,278                              | 6,769  | 33.7%              | 34.2%                               | 0.12%             | 8           |
| 2009                                    | 3,558                 | 1,843                              | 5,401  | 34.1%              | 31.3%                               | 2.94%             | 159         |
| 2010                                    | 3,792                 | 1,844                              | 5,635  | 32.7%              | 31.7%                               | 2.68%             | 151         |
| <i>Average annual percentage change</i> |                       |                                    |        |                    |                                     |                   |             |
| 1970–2010                               | -1.6%                 | 0.9%                               | -1.0%  |                    |                                     |                   |             |
| 2000–2010                               | -5.6%                 | -0.9%                              | -4.3%  |                    |                                     |                   |             |

**Source:**

Domestic and import data - 1970–97: American Automobile Manufacturers Association, *Motor Vehicle Facts and Figures 1998*, Detroit, MI, 1998, p. 15, and annual. 1997 data from *Economic Indicators, 4th Quarter 1997*. 1998–2010: Ward's Communication, *Ward's Automotive Yearbook*, Detroit, MI, 2009, p. 249. 2010: Ward's Communications, [www.wardsauto.com](http://www.wardsauto.com).

Diesel data - Ward's Communications, *Ward's Automotive Yearbook*, Detroit, MI, 2009, p. 31, and Ward's Communications, [www.wardsauto.com](http://www.wardsauto.com).

Transplant data - Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares Data System, Oak Ridge, TN, 2004. (Additional resources: [www.aama.com](http://www.aama.com), [www.wardsauto.com](http://www.wardsauto.com))

<sup>a</sup> North American built.

<sup>b</sup> Does not include import tourist deliveries.

<sup>c</sup> Big 3 includes Chrysler, Ford and General Motors. Beginning in 1998, Ford includes Jaguar and Volvo. GM Includes Saab.

<sup>d</sup> Data are not available.



*Light trucks, which include pick-ups, minivans, sport-utility vehicles, and other trucks less than 10,000 pounds gross vehicle weight (GVW), accounted for more than half of light vehicle sales from 2001 to 2007 and again in 2010.*

**Table 4.6**  
**New Retail Sales of Trucks 10,000 Pounds GVW and Less in the United States, 1970–2010**

| Percentages                             |   |                     |                  |                          |                     |   |                                   |
|---|---|---------------------|------------------|--------------------------|---------------------|---|-----------------------------------|
| Calendar year                           | Light truck sales <sup>a</sup><br>(thousands) | Import <sup>b</sup> | Data for Imports | Big 3 Sales <sup>c</sup> | Diesel <sup>d</sup> | Light trucks of light-duty vehicle sales <sup>e</sup> | Light trucks of total truck sales |
| 1970                                    | 1,463   | 4.5%                |                  |                          | <sup>f</sup>        | 14.8%   | 80.4%                             |
| 1975                                    | 2,281   | 10.0%               |                  |                          | <sup>f</sup>        | 20.9%   | 87.9%                             |
| 1980                                    | 2,230   | 21.5%               | 479              |                          | 3.5%                | 19.9%   | 89.4%                             |
| 1985                                    | 4,461   | 18.7%               | 832              | 78.2%                    | 3.3%                | 28.9%   | 94.0%                             |
| 1986                                    | 4,654   | 21.0%               | 978              | 76.9%                    | 3.7%                | 29.0%   | 94.6%                             |
| 1987                                    | 4,714   | 19.6%               | 922              | 78.3%                    | 2.3%                | 31.6%   | 94.3%                             |
| 1988                                    | 4,910   | 14.5%               | 711              | 81.6%                    | 2.3%                | 31.8%   | 93.6%                             |
| 1989                                    | 4,755   | 13.5%               | 641              | 81.9%                    | 2.9%                | 32.7%   | 93.8%                             |
| 1990                                    | 4,569   | 13.4%               | 612              | 80.9%                    | 2.2%                | 32.9%   | 94.3%                             |
| 1991                                    | 4,144   | 13.0%               | 538              | 79.4%                    | 3.2%                | 33.6%   | 94.9%                             |
| 1992                                    | 4,655   | 8.8%                | 408              | 83.1%                    | 2.4%                | 36.2%   | 94.9%                             |
| 1993                                    | 5,378   | 7.0%                | 377              | 83.4%                    | 2.3%                | 38.7%   | 94.7%                             |
| 1994                                    | 6,068   | 6.8%                | 410              | 82.9%                    | 2.5%                | 40.3%   | 94.5%                             |
| 1995                                    | 6,108   | 6.6%                | 402              | 83.4%                    | 3.8%                | 41.5%   | 94.0%                             |
| 1996                                    | 6,619   | 6.6%                | 438              | 83.8%                    | 3.1%                | 43.8%   | 94.9%                             |
| 1997                                    | 6,904   | 8.4%                | 580              | 81.9%                    | 2.7%                | 45.7%   | 94.8%                             |
| 1998                                    | 7,458   | 8.8%                | 656              | 80.5%                    | 2.6%                | 48.0%   | 94.6%                             |
| 1999                                    | 8,256   | 9.4%                | 775              | 78.0%                    | 2.8%                | 48.9%   | 94.1%                             |
| 2000                                    | 8,572   | 9.9%                | 852              | 76.1%                    | 3.3%                | 49.4%   | 94.9%                             |
| 2001                                    | 8,700   | 11.3%               | 981              | 75.3%                    | 2.8%                | 51.2%   | 96.2%                             |
| 2002                                    | 8,774   | 12.1%               | 1,066            | 74.7%                    | 2.7%                | 52.2%   | 96.5%                             |
| 2003                                    | 9,084   | 13.5%               | 1,227            | 72.4%                    | 2.8%                | 54.6%   | 96.5%                             |
| 2004                                    | 9,384   | 13.3%               | 1,246            | 70.1%                    | 2.7%                | 55.6%   | 95.6%                             |
| 2005                                    | 9,288   | 13.1%               | 1,215            | 68.2%                    | 2.7%                | 54.8%   | 94.9%                             |
| 2006                                    | 8,743   | 15.4%               | 1,347            | 63.9%                    | 2.8%                | 53.0%   | 94.1%                             |
| 2007                                    | 8,527   | 16.3%               | 1,388            | 61.9%                    | 3.1%                | 53.0%   | 95.8%                             |
| 2008                                    | 6,426   | 17.1%               | 1,096            | 59.8%                    | 3.3%                | 48.7%   | 95.6%                             |
| 2009                                    | 5,001   | 17.7%               | 884              | 56.5%                    | 4.0%                | 48.1%   | 96.2%                             |
| 2010                                    | 5,919   | 15.2%               | 899              | 56.3%                    | 4.8%                | 51.2%   | 96.5%                             |
| <i>Average annual percentage change</i> |   |                     |                  |                          |                     |   |                                   |
| 1970–2010                               | 3.6%  |                     |                  |                          |                     |   |                                   |
| 2000–2010                               | -3.6%   |                     |                  |                          |                     |   |                                   |

**Source:**

Ward's Communications, *Ward's Automotive Yearbook*, Detroit, MI, 2010, and updates at [www.wardsauto.com](http://www.wardsauto.com).  
(Additional resources: [www.wardsauto.com](http://www.wardsauto.com))

<sup>a</sup> Includes all trucks of 10,000 pounds gross vehicle weight and less sold in the United States.

<sup>b</sup> Excluding transplants.

<sup>c</sup> Big 3 includes Chrysler, Ford and General Motors. Beginning in 1998, Ford includes Land Rover and Volvo light trucks and GM includes Saab. Trucks include light, medium and heavy trucks.

<sup>d</sup> Based on model year factory installations.

<sup>e</sup> Light-duty vehicles include cars and light trucks.

<sup>f</sup> Indicates less than 1 percent.



*The sales-weighted fuel economy of new cars (including wagons) increased dramatically from 1975 (15.8 mpg) to 1985 (27.0 mpg), but rose only 2.5 mpg from 1985 to 2005. Since 2005, fuel economy rose 3.2 mpg—from 29.5 mpg in 2005 to 32.7 mpg in 2010.*

**Table 4.7**  
**Period Sales, Market Shares, and Sales-Weighted Fuel Economies**  
**of New Domestic and Import Cars, Selected Model Years 1975–2010<sup>a</sup>**  
**(thousands)**

|                    | Sales Period |        |        |        |        |                   |        |       |
|--------------------|--------------|--------|--------|--------|--------|-------------------|--------|-------|
|                    | 1975         | 1980   | 1985   | 1990   | 1995   | 2000              | 2005   | 2010  |
| <b>CARS</b>        |              |        |        |        |        |                   |        |       |
| <b>Small</b>       |              |        |        |        |        |                   |        |       |
| Total sales, units | 4,089        | 4,825  | 5,519  | 4,999  | 5,190  | 4,266             | 3,185  | 3,223 |
| Market share, %    | 49.6%        | 51.1%  | 51.1%  | 56.7%  | 55.2%  | 46.7%             | 39.7%  | 40.2% |
| Fuel economy, mpg  | 18.3         | 26.1   | 29.8   | 29.8   | 30.7   | 30.3              | 31.1   | 34.0  |
| <b>Midsize</b>     |              |        |        |        |        |                   |        |       |
| Total sales, units | 1,631        | 2,987  | 2,777  | 2,342  | 2,515  | 2,894             | 2,886  | 2,979 |
| Market share, %    | 19.8%        | 31.6%  | 25.7%  | 26.6%  | 26.8%  | 31.7%             | 36.0%  | 37.1% |
| Fuel economy, mpg  | 13.6         | 21.6   | 24.9   | 26.2   | 26.1   | 27.0              | 29.8   | 33.1  |
| <b>Large</b>       |              |        |        |        |        |                   |        |       |
| Total sales, units | 1,555        | 963    | 1,512  | 1,092  | 1,305  | 1,665             | 1,234  | 1,093 |
| Market share, %    | 18.9%        | 10.2%  | 14.0%  | 12.4%  | 13.9%  | 18.2%             | 15.4%  | 13.6% |
| Fuel economy, mpg  | 13.1         | 19.1   | 22.3   | 23.7   | 24.5   | 25.6              | 26.4   | 28.2  |
| <b>WAGONS</b>      |              |        |        |        |        |                   |        |       |
| <b>Small</b>       |              |        |        |        |        |                   |        |       |
| Total sales, units | 477          | 310    | 496    | 160    | 198    | 68                | 365    | 609   |
| Market share, %    | 5.8%         | 3.3%   | 4.6%   | 1.8%   | 2.1%   | 0.7%              | 4.5%   | 7.6%  |
| Fuel economy, mpg  | 22.4         | 28.6   | 32.5   | 29.6   | 33.3   | 29.2              | 32.4   | 34.5  |
| <b>Midsize</b>     |              |        |        |        |        |                   |        |       |
| Total sales, units | 289          | 257    | 341    | 184    | 176    | 234               | 238    | 105   |
| Market share, %    | 3.5%         | 2.7%   | 3.2%   | 2.1%   | 1.9%   | 2.6%              | 3.0%   | 1.3%  |
| Fuel economy, mpg  | 13.2         | 21.1   | 25.2   | 25.3   | 26.6   | 27.3              | 26.0   | 28.5  |
| <b>Large</b>       |              |        |        |        |        |                   |        |       |
| Total sales, units | 197          | 102    | 145    | 31     | 10     | 0                 | 118    | 11    |
| Market share, %    | 2.4%         | 1.1%   | 1.4%   | 0.4%   | 0.1%   | 0.0% <sup>b</sup> | 1.5%   | 0.1%  |
| Fuel economy, mpg  | 11.9         | 19.1   | 20.9   | 22.7   | 22.8   |                   | 22.2   | 21.0  |
| <b>TOTAL</b>       |              |        |        |        |        |                   |        |       |
| Total sales, units | 8,238        | 9,443  | 10,791 | 8,810  | 9,396  | 9,128             | 8,027  | 8,020 |
| Market share, %    | 100.0%       | 100.0% | 100.0% | 100.0% | 100.0% | 100.0%            | 100.0% | 100%  |
| Fuel economy, mpg  | 15.8         | 23.5   | 27.0   | 27.8   | 28.3   | 28.2              | 29.5   | 32.7  |

**Source:**

U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2021*, November 2010. (Additional resources: [www.epa.gov/otaq/fetrends.htm](http://www.epa.gov/otaq/fetrends.htm))

<sup>a</sup> The fuel economy data on this table are EPA laboratory test values.

<sup>b</sup> No vehicles in this category were sold in this model year.



*The term “wagon” conjures up images of the station wagons from the 1960's. However, most of the cars that are now classified as wagons have little in common with those station wagons. The wagons below make up the category “wagon” on Tables 4.7 through 4.14.*

**Table 4.8**  
**Definition of Wagons in Model Year 2010**

| <b>Small Wagon</b>                 |
|------------------------------------|
| Audi A3                            |
| Audi A3 Quattro                    |
| Audi A4 Avant Quattro              |
| BMW 328I Sport Wagon               |
| BMW 328I Sport Wagon xDrive        |
| Cadillac CTS Wagon                 |
| Cadillac CTS Wagon AWD             |
| Chevrolet HHR FWD                  |
| Chevrolet HHR Panel FWD            |
| Chrysler PT Cruiser                |
| Honda Fit                          |
| Hyundai Elantra Touring            |
| Kia Soul                           |
| Mitsubishi Lancer Sportback        |
| Nissan Cube                        |
| Pontiac Vibe                       |
| Saab 9-3 Sportcombi                |
| Saab 9-3X Sportcombi AWD           |
| Subaru Impreza Wagon-Outback Sport |
| Suzuki SX4                         |
| Suzuki SX4 AWD                     |
| Toyota Corolla Matrix              |
| Toyota Scion XB                    |
| Volkswagen Jetta Sportwagen        |
| Volvo V50 AWD                      |
| Volvo V50 FWD                      |
| <b>Midsized Wagon</b>              |
| Audi A6 Avant Quattro              |
| BMW 535i Sport Wagon xDrive        |
| Kia Rondo                          |
| Lincoln MKT AWD                    |
| Lincoln MKT FWD                    |
| Subaru Outback Wagon AWD           |
| Volkswagen Passat Wagon            |
| Volvo V70 FWD                      |
| Volvo XC70 AWD                     |
| <b>Large Wagon</b>                 |
| Mercedes Benz R350 Bluetec         |
| Mercedes Benz R350 4MATIC          |

**Source:**

U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2010*, November 2010. (Additional resources: [www.epa.gov/otaq/fetrends.htm](http://www.epa.gov/otaq/fetrends.htm))





*Sales of light trucks in 2010 are almost three times that of 1975. Similar to the car trend, the sales-weighted fuel economy of light trucks increased substantially during the late '70's and '80's, but has increased slowly until the mid-2000's. From 2005 to 2010, fuel economy rose from 21.4 mpg to 23.8 mpg.*

**Table 4.9**  
**Period Sales, Market Shares, and Sales-Weighted Fuel Economies<sup>a</sup> of New Domestic and Import Light Trucks, Model Years 1975–2010**  
**(thousands)**

|                    | Sales Period |        |        |        |        |              |              |              |
|--------------------|--------------|--------|--------|--------|--------|--------------|--------------|--------------|
|                    | 1975         | 1980   | 1985   | 1990   | 1995   | 2000         | 2005         | 2010         |
| <b>PICKUPS</b>     |              |        |        |        |        |              |              |              |
| <b>Small</b>       |              |        |        |        |        |              |              |              |
| Total sales, units | 160          | 452    | 497    | 289    | 298    | 101          | 8            | <sup>b</sup> |
| Market share, %    | 8.1%         | 24.3%  | 13.5%  | 7.6%   | 5.2%   | 1.4%         | 0.1%         | 0.0%         |
| Fuel economy, mpg  | 22.5         | 24.3   | 26.7   | 24.8   | 24.4   | 26.3         | 25.8         | <sup>b</sup> |
| <b>Midsized</b>    |              |        |        |        |        |              |              |              |
| Total sales, units | 56           | 98     | 617    | 600    | 700    | 766          | 216          | 196          |
| Market share, %    | 2.8%         | 5.3%   | 16.8%  | 15.8%  | 12.2%  | 10.3%        | 2.7%         | 3.5%         |
| Fuel economy, mpg  | 21.1         | 25.9   | 25.7   | 24.7   | 24.7   | 22.8         | 23.6         | 25.2         |
| <b>Large</b>       |              |        |        |        |        |              |              |              |
| Total sales, units | 1,126        | 887    | 964    | 945    | 1,273  | 1,746        | 2,076        | 1,527        |
| Market share, %    | 56.7%        | 47.6%  | 26.3%  | 24.8%  | 22.1%  | 23.4%        | 26.4%        | 27.3%        |
| Fuel economy, mpg  | 13.1         | 17.2   | 17.7   | 18.0   | 18.0   | 19.3         | 19.4         | 20.6         |
| <b>VANS</b>        |              |        |        |        |        |              |              |              |
| <b>Small</b>       |              |        |        |        |        |              |              |              |
| Total sales, units | 2            | 16     | 93     | 31     | 6      | <sup>b</sup> | <sup>b</sup> | 11           |
| Market share, %    | 0.1%         | 0.9%   | 2.5%   | 0.8%   | 0.1%   | <sup>b</sup> | <sup>b</sup> | 0.2%         |
| Fuel economy, mpg  | 20.6         | 19.0   | 25.5   | 23.9   | 26.5   | <sup>b</sup> | <sup>b</sup> | 30.7         |
| <b>Midsized</b>    |              |        |        |        |        |              |              |              |
| Total sales, units | 302          | 130    | 600    | 1,124  | 1,552  | 1,522        | 1,426        | 450          |
| Market share, %    | 15.2%        | 7.0%   | 16.4%  | 29.5%  | 27.0%  | 20.4%        | 18.1%        | 8.0%         |
| Fuel economy, mpg  | 13.3         | 16.9   | 19.8   | 21.8   | 22.2   | 23.5         | 24.2         | 25.1         |
| <b>Large</b>       |              |        |        |        |        |              |              |              |
| Total sales, units | 153          | 96     | 162    | 107    | 104    | 170          | 55           | 18           |
| Market share, %    | 7.7%         | 5.2%   | 4.4%   | 2.8%   | 1.8%   | 2.3%         | 0.7%         | 0.3%         |
| Fuel economy, mpg  | 12.6         | 16.0   | 16.1   | 16.5   | 17.1   | 18.0         | 19.4         | 20.0         |
| <b>SUVs</b>        |              |        |        |        |        |              |              |              |
| <b>Small</b>       |              |        |        |        |        |              |              |              |
| Total sales, units | 54           | 61     | 115    | 190    | 190    | 400          | 215          | 67           |
| Market share, %    | 2.7%         | 3.3%   | 3.1%   | 5.0%   | 3.3%   | 5.4%         | 2.7%         | 1.2%         |
| Fuel economy, mpg  | 16.1         | 18.8   | 22.1   | 23.4   | 24.2   | 22.5         | 24.3         | 21.4         |
| <b>Midsized</b>    |              |        |        |        |        |              |              |              |
| Total sales, units | 123          | 100    | 563    | 447    | 1,397  | 1,863        | 2,080        | 1,912        |
| Market share, %    | 6.2%         | 5.4%   | 15.3%  | 11.7%  | 24.3%  | 25.0%        | 26.4%        | 34.1%        |
| Fuel economy, mpg  | 12.1         | 14.3   | 19.7   | 19.1   | 19.6   | 21.0         | 23.0         | 27.4         |
| <b>Large</b>       |              |        |        |        |        |              |              |              |
| Total sales, units | 11           | 24     | 57     | 72     | 230    | 880          | 1,790        | 1,420        |
| Market share, %    | 0.6%         | 1.3%   | 1.6%   | 1.9%   | 4.0%   | 11.8%        | 22.8%        | 25.4%        |
| Fuel economy, mpg  | 12.2         | 14.3   | 16.9   | 16.7   | 16.6   | 17.6         | 19.9         | 23.2         |
| <b>TOTAL</b>       |              |        |        |        |        |              |              |              |
| Total sales, units | 1,987        | 1,863  | 3,669  | 3,805  | 5,749  | 7,447        | 7,866        | 5,601        |
| Market share, %    | 100.0%       | 100.0% | 100.0% | 100.0% | 100.0% | 100.0%       | 100.0%       | 100.0%       |
| Fuel economy, mpg  | 13.7         | 18.6   | 20.6   | 20.7   | 20.5   | 20.8         | 21.4         | 23.8         |

**Source:**

U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2010*, November 2010. (Additional resources: [www.epa.gov/otaq/fetrends.htm](http://www.epa.gov/otaq/fetrends.htm))

**Note:** Includes light trucks of 8,500 lbs. or less.

<sup>a</sup> The fuel economy data on this table are EPA laboratory test values.

<sup>b</sup> No vehicles in this category were sold in this model year.



*Back in 1975 only 19% of new light vehicle sales were light trucks. Because of the boom in sales of minivans, sport utility vehicles, and pick-up trucks, that number rose to nearly 50% in 2005. In 2010, cars made a comeback to account for 58.9%.*

**Table 4.10**  
**Light Vehicle Market Shares by Size Class, Model Years 1975–2010**

|  | Model Year |        |        |        |        |        |        |        |
|--|------------|--------|--------|--------|--------|--------|--------|--------|
|  | 1975       | 1980   | 1985   | 1990   | 1995   | 2000   | 2005   | 2010   |
| Small car                                | 40.0%      | 42.7%  | 38.2%  | 39.6%  | 34.3%  | 25.7%  | 20.0%  | 23.7%  |
| Midsize car                              | 16.0%      | 26.4%  | 19.2%  | 18.6%  | 16.6%  | 17.5%  | 18.2%  | 21.9%  |
| Large car                                | 15.2%      | 8.5%   | 10.5%  | 8.7%   | 8.6%   | 10.0%  | 7.8%   | 18.8%  |
| Small wagon                              | 4.7%       | 2.7%   | 3.4%   | 1.3%   | 1.3%   | 0.4%   | 2.3%   | 4.5%   |
| Midsize wagon                            | 2.8%       | 2.3%   | 2.4%   | 1.5%   | 1.2%   | 1.4%   | 1.5%   | 0.8%   |
| Large wagon                              | 1.9%       | 0.9%   | 1.0%   | 0.2%   | 0.1%   | 0.0%   | 0.7%   | 0.1%   |
| Small pickup                             | 1.6%       | 4.0%   | 3.4%   | 2.3%   | 2.0%   | 0.6%   | 0.1%   | 0.0%   |
| Midsize pickup                           | 0.5%       | 0.9%   | 4.3%   | 4.8%   | 4.6%   | 4.6%   | 1.4%   | 1.4%   |
| Large pickup                             | 11.0%      | 7.8%   | 6.7%   | 7.5%   | 8.4%   | 10.5%  | 13.1%  | 11.2%  |
| Small van                                | 0.0%       | 0.1%   | 0.6%   | 0.2%   | 0.0%   | 0.0%   | 0.0%   | 0.1%   |
| Midsize van                              | 3.0%       | 1.1%   | 4.1%   | 8.9%   | 10.2%  | 9.2%   | 9.0%   | 3.3%   |
| Large van                                | 1.5%       | 0.8%   | 1.1%   | 0.9%   | 0.7%   | 1.0%   | 0.3%   | 0.1%   |
| Small SUV                                | 0.5%       | 0.5%   | 0.8%   | 1.5%   | 1.3%   | 2.4%   | 1.4%   | 0.5%   |
| Midsize SUV                              | 1.2%       | 0.9%   | 3.9%   | 3.5%   | 9.2%   | 11.2%  | 13.1%  | 14.0%  |
| Large SUV                                | 0.1%       | 0.2%   | 0.4%   | 0.6%   | 1.5%   | 5.3%   | 11.3%  | 10.4%  |
| Total light vehicles sold<br>(thousands) | 10,225     | 11,306 | 14,460 | 12,615 | 15,145 | 16,575 | 15,893 | 13,621 |
| Cars                                     | 80.6%      | 83.5%  | 74.6%  | 69.8%  | 62.0%  | 55.1%  | 50.5%  | 58.9%  |
| Light trucks                             | 19.4%      | 16.5%  | 25.4%  | 30.2%  | 38.0%  | 44.9%  | 49.5%  | 41.1%  |

**Source:**

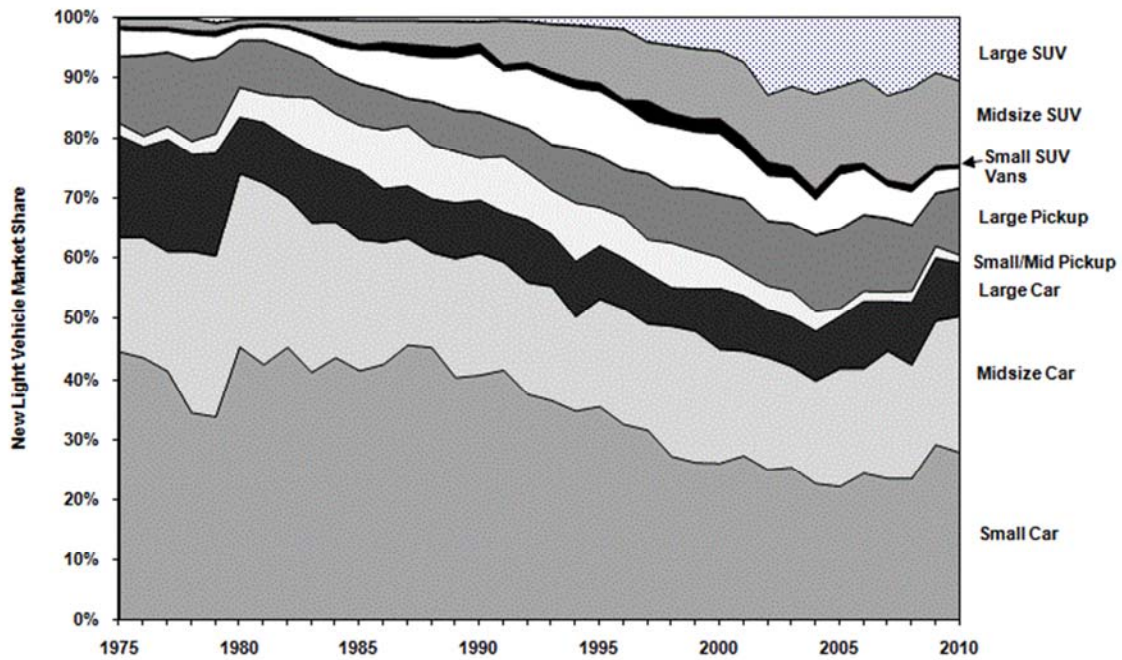
U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2010*, November 2010. (Additional resources: [www.epa.gov/otaq/fetrends.htm](http://www.epa.gov/otaq/fetrends.htm))

**Note:** Includes light trucks of 8,500 lbs. or less.



*Light trucks were gaining market share from the early 1980s until 2004, mainly due to increases in the market share of sport utility vehicles (SUVs) and pickup trucks. Small and midsize cars had a large increase in market share in 2009, likely due to the Federal Government incentive program for fuel-efficient vehicles.*

**Figure 4.1. Light Vehicle Market Shares, Model Years 1975–2010**



**Source:**  
See Table 4.10



*The midsize and large cars and wagons sales-weighted engine sizes have decreased at an average of about 2% per year since 1975.*

**Table 4.11**  
**Sales-Weighted Engine Size of New Domestic and Import Cars by Size Class,**  
**Model Years 1975–2010**  
**( liters<sup>a</sup>)**

| Model Year                              | Cars  |         |       | Wagons |         |                    |
|---|-------|---------|-------|--------|---------|--------------------|
|   | Small | Midsize | Large | Small  | Midsize | Large              |
| 1975                                    | 3.67  | 5.78    | 6.70  | 2.10   | 5.92    | 6.72               |
| 1976                                    | 3.70  | 5.62    | 6.72  | 2.23   | 5.16    | 6.82               |
| 1977                                    | 3.67  | 5.44    | 6.00  | 2.20   | 4.87    | 5.98               |
| 1978                                    | 2.90  | 4.79    | 5.85  | 2.20   | 4.23    | 5.80               |
| 1979                                    | 2.72  | 4.46    | 5.56  | 2.02   | 4.08    | 5.46               |
| 1980                                    | 2.25  | 3.74    | 5.15  | 1.85   | 3.74    | 5.31               |
| 1981                                    | 2.13  | 3.61    | 4.98  | 1.77   | 3.16    | 5.13               |
| 1982                                    | 2.15  | 3.46    | 4.79  | 1.79   | 3.36    | 5.01               |
| 1983                                    | 2.25  | 3.47    | 4.80  | 1.72   | 3.28    | 5.03               |
| 1984                                    | 2.31  | 3.44    | 4.82  | 1.75   | 2.82    | 5.00               |
| 1985                                    | 2.26  | 3.36    | 4.57  | 1.75   | 2.79    | 5.00               |
| 1986                                    | 2.26  | 3.18    | 4.26  | 1.85   | 2.65    | 4.98               |
| 1987                                    | 2.20  | 3.08    | 4.26  | 1.90   | 2.84    | 4.98               |
| 1988                                    | 2.18  | 3.00    | 4.29  | 1.85   | 2.80    | 4.98               |
| 1989                                    | 2.15  | 2.97    | 4.29  | 1.84   | 2.88    | 4.98               |
| 1990                                    | 2.15  | 3.06    | 4.23  | 1.97   | 2.97    | 4.98               |
| 1991                                    | 2.15  | 3.13    | 4.33  | 1.97   | 2.97    | 4.98               |
| 1992                                    | 2.20  | 3.13    | 4.29  | 2.00   | 3.08    | 5.54               |
| 1993                                    | 2.18  | 3.15    | 4.20  | 1.93   | 3.08    | 5.57               |
| 1994                                    | 2.25  | 3.11    | 4.08  | 1.98   | 2.95    | 5.74               |
| 1995                                    | 2.25  | 3.10    | 4.06  | 1.93   | 2.74    | 5.74               |
| 1996                                    | 2.23  | 2.97    | 4.10  | 2.00   | 2.64    | 5.74               |
| 1997                                    | 2.18  | 3.02    | 3.97  | 2.05   | 2.62    | <sup>b</sup>       |
| 1998                                    | 2.25  | 2.90    | 3.93  | 2.03   | 2.54    | <sup>b</sup>       |
| 1999                                    | 2.31  | 2.87    | 3.85  | 2.05   | 2.57    | <sup>b</sup>       |
| 2000                                    | 2.28  | 2.85    | 3.62  | 2.08   | 2.51    | <sup>b</sup>       |
| 2001                                    | 2.29  | 2.87    | 3.62  | 2.38   | 2.54    | <sup>b</sup>       |
| 2002                                    | 2.31  | 2.90    | 3.57  | 2.38   | 2.51    | <sup>b</sup>       |
| 2003                                    | 2.34  | 2.85    | 3.67  | 2.08   | 2.47    | <sup>b</sup>       |
| 2004                                    | 2.39  | 2.85    | 3.69  | 2.06   | 2.59    | 3.52               |
| 2005                                    | 2.36  | 2.75    | 3.69  | 2.00   | 3.00    | 3.56               |
| 2006                                    | 2.47  | 2.77    | 3.77  | 2.08   | 3.00    | 3.59               |
| 2007                                    | 2.39  | 2.70    | 3.75  | 2.08   | 2.64    | 3.88               |
| 2008                                    | 2.43  | 2.67    | 3.49  | 2.13   | 2.67    | 3.72               |
| 2009                                    | 2.29  | 2.59    | 3.28  | 2.05   | 2.51    | 3.43               |
| 2010                                    | 2.41  | 2.67    | 3.34  | 2.02   | 2.74    | 3.46               |
| <i>Average annual percentage change</i> |       |         |       |        |         |                    |
| 1975–2010                               | -1.2% | -2.2%   | -2.0% | -0.1%  | -2.2%   | -1.9%              |
| 2000–2010                               | 0.6%  | -0.7%   | -0.8% | -0.3%  | 0.9%    | -3.6% <sup>c</sup> |

**Source:**

U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2010*, November 2010. (Additional resources: [www.epa.gov/otaq/fetrends.htm](http://www.epa.gov/otaq/fetrends.htm))

<sup>a</sup> 1 liter = 61.02 cubic inches.

<sup>b</sup> No vehicles in this category were sold in this model year.

<sup>c</sup> 1996–2010.



*The engine size of large sport utility vehicles (SUVs) declined an average of 2.5% per year from 2000 to 2010, while the size of a small SUV engine increased by 3.1%.*

**Table 4.12**  
**Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class,**  
**Model Years 1975–2010**  
**(liters<sup>a</sup>)**

| Model Year                              | Pickups      |         |       | Vans         |         |       | SUVs  |         |       |
|---|--------------|---------|-------|--------------|---------|-------|-------|---------|-------|
|   | Small        | Midsize | Large | Small        | Midsize | Large | Small | Midsize | Large |
| 1975                                    | 1.93         | 1.79    | 5.62  | 1.93         | 5.08    | 5.47  | 4.47  | 5.72    | 5.97  |
| 1976                                    | 1.95         | 1.79    | 5.64  | 1.97         | 5.20    | 5.51  | 4.47  | 5.80    | 6.11  |
| 1977                                    | 1.98         | 2.03    | 5.69  | 1.97         | 5.34    | 5.62  | 4.49  | 5.72    | 6.08  |
| 1978                                    | 1.97         | 2.03    | 5.56  | 1.97         | 5.36    | 5.49  | 4.52  | 5.87    | 6.11  |
| 1979                                    | 1.97         | 2.15    | 5.41  | 1.97         | 5.24    | 5.51  | 4.28  | 5.64    | 6.15  |
| 1980                                    | 2.00         | 2.18    | 5.00  | 1.97         | 4.72    | 5.16  | 3.72  | 5.31    | 5.59  |
| 1981                                    | 2.13         | 2.15    | 4.80  | 1.97         | 4.57    | 5.08  | 3.69  | 5.20    | 5.54  |
| 1982                                    | 2.25         | 2.49    | 4.90  | 1.82         | 4.65    | 5.15  | 3.39  | 5.24    | 5.64  |
| 1983                                    | 2.33         | 2.39    | 4.95  | 1.93         | 4.82    | 5.15  | 3.44  | 4.10    | 5.82  |
| 1984                                    | 2.33         | 2.43    | 4.93  | 1.97         | 4.06    | 5.15  | 3.05  | 3.70    | 5.75  |
| 1985                                    | 2.34         | 2.52    | 5.00  | 1.98         | 3.82    | 5.11  | 2.74  | 3.47    | 5.74  |
| 1986                                    | 2.38         | 2.41    | 4.88  | 2.15         | 3.67    | 5.01  | 2.74  | 3.36    | 5.74  |
| 1987                                    | 2.41         | 2.61    | 5.06  | 2.20         | 3.70    | 5.06  | 2.64  | 3.54    | 5.74  |
| 1988                                    | 2.43         | 2.70    | 5.21  | 2.20         | 3.65    | 5.06  | 2.57  | 3.83    | 5.75  |
| 1989                                    | 2.51         | 2.90    | 5.21  | 2.13         | 3.57    | 5.06  | 2.80  | 4.16    | 5.75  |
| 1990                                    | 2.51         | 2.87    | 5.24  | 2.29         | 3.59    | 5.15  | 2.65  | 3.98    | 5.75  |
| 1991                                    | 2.49         | 3.11    | 5.16  | 2.03         | 3.51    | 5.11  | 2.38  | 3.87    | 5.38  |
| 1992                                    | 2.49         | 3.20    | 5.11  | 2.11         | 3.57    | 5.16  | 2.39  | 3.82    | 5.42  |
| 1993                                    | 2.41         | 3.24    | 4.97  | 2.00         | 3.46    | 5.16  | 2.46  | 3.97    | 5.65  |
| 1994                                    | 2.47         | 3.23    | 5.18  | 2.21         | 3.59    | 5.21  | 2.28  | 3.90    | 5.62  |
| 1995                                    | 2.57         | 3.11    | 5.20  | 2.21         | 3.70    | 5.15  | 2.26  | 3.88    | 5.69  |
| 1996                                    | 2.61         | 3.06    | 5.16  | 2.33         | 3.47    | 5.33  | 1.75  | 4.08    | 5.64  |
| 1997                                    | 2.39         | 3.21    | 4.97  | <sup>b</sup> | 3.44    | 4.92  | 2.98  | 3.85    | 5.38  |
| 1998                                    | 2.62         | 3.15    | 5.05  | <sup>b</sup> | 3.43    | 4.87  | 2.65  | 3.87    | 5.13  |
| 1999                                    | 2.84         | 3.28    | 5.13  | <sup>b</sup> | 3.49    | 4.87  | 2.57  | 3.74    | 5.29  |
| 2000                                    | 2.43         | 3.15    | 4.74  | <sup>b</sup> | 3.41    | 4.85  | 2.80  | 3.75    | 5.11  |
| 2001                                    | 2.41         | 3.39    | 4.79  | <sup>b</sup> | 3.38    | 4.97  | 2.51  | 3.51    | 4.64  |
| 2002                                    | 2.90         | 3.70    | 4.82  | <sup>b</sup> | 3.44    | 4.80  | 2.56  | 3.34    | 4.54  |
| 2003                                    | 2.92         | 3.23    | 4.82  | <sup>b</sup> | 3.47    | 4.74  | 2.64  | 3.39    | 4.72  |
| 2004                                    | 3.02         | 3.59    | 4.95  | <sup>b</sup> | 3.51    | 4.79  | 2.97  | 3.51    | 4.74  |
| 2005                                    | 2.46         | 3.15    | 4.82  | <sup>b</sup> | 3.49    | 4.72  | 2.92  | 3.34    | 4.46  |
| 2006                                    | 2.46         | 3.23    | 4.75  | <sup>b</sup> | 3.47    | 4.64  | 3.28  | 3.34    | 4.24  |
| 2007                                    | <sup>b</sup> | 3.31    | 4.88  | <sup>b</sup> | 3.54    | 4.64  | 3.39  | 3.18    | 4.39  |
| 2008                                    | <sup>b</sup> | 3.29    | 4.95  | 2.29         | 3.59    | 4.62  | 3.52  | 3.10    | 4.24  |
| 2009                                    | <sup>b</sup> | 3.31    | 5.01  | 2.29         | 3.56    | 4.67  | 3.79  | 2.93    | 3.93  |
| 2010                                    | <sup>b</sup> | 3.21    | 5.05  | 2.29         | 3.51    | 4.79  | 3.80  | 3.00    | 3.98  |
| <i>Average annual percentage change</i> |              |         |       |              |         |       |       |         |       |
| 1975-2010                               | <sup>c</sup> | 1.7%    | -1.6% | 0.5%         | -1.1%   | -0.4% | -0.5% | -1.8%   | -1.2% |
| 2000-2010                               | <sup>c</sup> | 0.2%    | 0.6%  | <sup>c</sup> | 0.3%    | -0.1% | 3.1%  | -2.2%   | -2.5% |

**Source:**

U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2010*, November 2010. (Additional resources: [www.epa.gov/otaq/fetrends.htm](http://www.epa.gov/otaq/fetrends.htm))

**Note:** Includes light trucks of 8,500 lbs. or less.

<sup>a</sup> 1 liter = 61.02 cubic inches.

<sup>b</sup> No vehicles in this category were sold in this model year.

<sup>c</sup> Data are not available.



**Table 4.13**  
**Sales-Weighted Curb Weight of New Domestic and Import Cars by Size Class,**  
**Model Years 1975–2010**  
**(pounds)**

| Model Year                              | Cars  |         |       | Wagons |         |                   |
|---|-------|---------|-------|--------|---------|-------------------|
|   | Small | Midsize | Large | Small  | Midsize | Large             |
| 1975                                    | 3,440 | 4,630   | 5,142 | 2,834  | 4,791   | 5,453             |
| 1976                                    | 3,474 | 4,558   | 5,156 | 2,902  | 4,555   | 5,444             |
| 1977                                    | 3,486 | 4,474   | 4,482 | 2,801  | 4,410   | 4,713             |
| 1978                                    | 3,029 | 3,820   | 4,394 | 2,805  | 3,836   | 4,664             |
| 1979                                    | 2,936 | 3,710   | 4,210 | 2,711  | 3,758   | 4,467             |
| 1980                                    | 2,717 | 3,362   | 4,130 | 2,591  | 3,535   | 4,423             |
| 1981                                    | 2,648 | 3,346   | 4,108 | 2,531  | 3,285   | 4,394             |
| 1982                                    | 2,684 | 3,321   | 4,034 | 2,580  | 3,384   | 4,396             |
| 1983                                    | 2,734 | 3,316   | 4,041 | 2,565  | 3,348   | 4,380             |
| 1984                                    | 2,776 | 3,318   | 4,022 | 2,620  | 3,298   | 4,371             |
| 1985                                    | 2,771 | 3,319   | 3,841 | 2,579  | 3,356   | 4,354             |
| 1986                                    | 2,791 | 3,241   | 3,719 | 2,648  | 3,355   | 4,381             |
| 1987                                    | 2,803 | 3,247   | 3,696 | 2,795  | 3,434   | 4,348             |
| 1988                                    | 2,818 | 3,293   | 3,730 | 2,757  | 3,378   | 4,349             |
| 1989                                    | 2,841 | 3,314   | 3,721 | 2,766  | 3,436   | 4,334             |
| 1990                                    | 2,897 | 3,450   | 3,799 | 3,026  | 3,499   | 4,337             |
| 1991                                    | 2,886 | 3,412   | 3,893 | 3,005  | 3,506   | 4,403             |
| 1992                                    | 2,921 | 3,515   | 3,872 | 3,076  | 3,504   | 4,500             |
| 1993                                    | 2,903 | 3,515   | 3,831 | 2,882  | 3,498   | 4,500             |
| 1994                                    | 2,965 | 3,529   | 3,859 | 2,908  | 3,533   | 4,500             |
| 1995                                    | 2,988 | 3,546   | 3,830 | 2,859  | 3,482   | 4,500             |
| 1996                                    | 2,977 | 3,527   | 3,895 | 2,952  | 3,661   | 4,500             |
| 1997                                    | 2,977 | 3,551   | 3,821 | 2,901  | 3,666   | <sup>a</sup>      |
| 1998                                    | 3,013 | 3,534   | 3,784 | 2,874  | 3,669   | <sup>a</sup>      |
| 1999                                    | 3,085 | 3,540   | 3,854 | 2,923  | 3,691   | <sup>a</sup>      |
| 2000                                    | 3,079 | 3,550   | 3,782 | 3,107  | 3,572   | <sup>a</sup>      |
| 2001                                    | 3,101 | 3,566   | 3,774 | 3,470  | 3,775   | <sup>a</sup>      |
| 2002                                    | 3,125 | 3,549   | 3,768 | 3,504  | 3,732   | <sup>a</sup>      |
| 2003                                    | 3,169 | 3,567   | 3,841 | 3,262  | 3,745   | <sup>a</sup>      |
| 2004                                    | 3,192 | 3,577   | 3,858 | 3,235  | 3,860   | 4,769             |
| 2005                                    | 3,163 | 3,545   | 3,933 | 3,160  | 3,839   | 4,791             |
| 2006                                    | 3,255 | 3,568   | 4,014 | 3,255  | 3,827   | 4,806             |
| 2007                                    | 3,238 | 3,581   | 4,026 | 3,264  | 3,727   | 4,785             |
| 2008                                    | 3,284 | 3,564   | 3,966 | 3,300  | 3,845   | 5,017             |
| 2009                                    | 3,251 | 3,554   | 3,883 | 3,263  | 3,653   | 5,500             |
| 2010                                    | 3,263 | 3,630   | 3,924 | 3,217  | 4,064   | 5,500             |
| <i>Average annual percentage change</i> |       |         |       |        |         |                   |
| 1975-2010                               | -0.2% | -0.7%   | -0.8% | 0.4%   | -0.5%   | 0.0%              |
| 2000-2010                               | 0.6%  | 0.2%    | 0.4%  | 0.3%   | 1.3%    | 1.4% <sup>b</sup> |

**Source:**

U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2010*, November 2010. (Additional resources: [www.epa.gov/otaq/fetrends.htm](http://www.epa.gov/otaq/fetrends.htm))

<sup>a</sup> Data are not available.

<sup>b</sup> 1996–2010.



*The interior space of new small and midsize cars in 2010 was about the same as in the late 1990's; large cars, however, had smaller interior space.*

**Table 4.14**  
**Sales-Weighted Interior Space of New Domestic and Import Cars by Size Class,**  
**Model Years 1977–2010**  
**(cubic feet)**

| Model Year                              | Cars  |         |       | Wagons |         |                    |
|---|-------|---------|-------|--------|---------|--------------------|
|   | Small | Midsize | Large | Small  | Midsize | Large              |
| 1977                                    | 95.4  | 112.9   | 128.1 | 108.0  | 143.6   | 163.1              |
| 1978                                    | 90.9  | 113.0   | 128.5 | 108.0  | 140.0   | 162.4              |
| 1979                                    | 89.2  | 113.1   | 130.0 | 105.1  | 139.7   | 162.5              |
| 1980                                    | 90.0  | 113.2   | 130.9 | 108.2  | 139.7   | 161.5              |
| 1981                                    | 91.6  | 113.9   | 131.0 | 110.6  | 136.2   | 161.4              |
| 1982                                    | 92.2  | 113.9   | 131.0 | 112.2  | 136.1   | 161.3              |
| 1983                                    | 95.1  | 113.8   | 131.3 | 108.2  | 136.2   | 161.6              |
| 1984                                    | 95.2  | 113.7   | 130.9 | 116.5  | 135.9   | 161.7              |
| 1985                                    | 95.8  | 113.6   | 129.3 | 117.7  | 134.8   | 161.7              |
| 1986                                    | 96.7  | 113.8   | 127.4 | 118.4  | 137.8   | 161.4              |
| 1987                                    | 96.9  | 113.7   | 127.0 | 120.0  | 140.2   | 161.8              |
| 1988                                    | 98.5  | 113.4   | 128.1 | 118.7  | 139.4   | 161.7              |
| 1989                                    | 98.3  | 113.6   | 127.4 | 118.6  | 139.9   | 161.8              |
| 1990                                    | 97.6  | 113.7   | 126.7 | 122.2  | 141.6   | 161.6              |
| 1991                                    | 97.6  | 113.5   | 129.0 | 123.3  | 142.3   | 169.1              |
| 1992                                    | 97.9  | 113.9   | 129.6 | 123.7  | 142.6   | 170.3              |
| 1993                                    | 98.3  | 113.9   | 128.9 | 123.0  | 137.7   | 169.3              |
| 1994                                    | 98.7  | 113.5   | 128.3 | 122.9  | 137.4   | 169.2              |
| 1995                                    | 99.6  | 114.3   | 127.9 | 122.1  | 135.9   | 169.3              |
| 1996                                    | 99.9  | 114.1   | 128.1 | 118.0  | 136.9   | 170.2              |
| 1997                                    | 99.2  | 114.5   | 127.4 | 119.5  | 136.5   | <sup>a</sup>       |
| 1998                                    | 98.8  | 114.0   | 127.4 | 116.9  | 135.3   | <sup>a</sup>       |
| 1999                                    | 98.9  | 114.0   | 127.0 | 117.9  | 136.4   | <sup>a</sup>       |
| 2000                                    | 99.4  | 113.6   | 124.9 | 119.7  | 134.0   | <sup>a</sup>       |
| 2001                                    | 99.2  | 113.7   | 124.8 | 119.6  | 133.6   | <sup>a</sup>       |
| 2002                                    | 98.9  | 114.8   | 124.3 | 118.2  | 133.6   | <sup>a</sup>       |
| 2003                                    | 99.4  | 114.6   | 124.8 | 115.2  | 133.5   | <sup>a</sup>       |
| 2004                                    | 99.0  | 114.0   | 124.7 | 117.5  | 135.0   | 165.0              |
| 2005                                    | 99.1  | 114.5   | 125.0 | 115.9  | 133.3   | 165.0              |
| 2006                                    | 98.8  | 114.0   | 124.7 | 118.4  | 135.6   | 164.4              |
| 2007                                    | 99.3  | 113.8   | 123.8 | 112.0  | 135.4   | 159.2              |
| 2008                                    | 98.3  | 113.3   | 123.2 | 115.0  | 134.6   | 160.1              |
| 2009                                    | 99.8  | 113.9   | 122.6 | 114.8  | 133.7   | 161.7              |
| 2010                                    | 99.8  | 114.5   | 122.9 | 115.8  | 139.2   | 161.7              |
| <i>Average annual percentage change</i> |       |         |       |        |         |                    |
| 1977-2010                               | 0.1%  | 0.0%    | -0.1% | 0.2%   | -0.1%   | 0.0%               |
| 2000-2010                               | 0.0%  | 0.1%    | -0.2% | -0.3%  | -0.4%   | -0.4% <sup>b</sup> |

**Source:**

U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2010*, November 2010. (Additional resources: [www.epa.gov/otaq/fetrends.htm](http://www.epa.gov/otaq/fetrends.htm))

<sup>a</sup> No vehicles in this category were sold in this model year.

<sup>b</sup> 1996-2010.



*The average light vehicle in 2009 contained more than 2,000 pounds of steel, most of it conventional steel. High and medium strength steel, however, made up more than 10% of the vehicle. The use of aluminum grew from 1995 to 2009, while the use of iron castings declined.*

**Table 4.15**  
**Average Material Consumption for a Domestic Light Vehicle,**  
**Model Years 1995, 2000, and 2009**

| Material                        | 1995    |            | 2000    |            | 2009    |            |
|---------------------------------|---------|------------|---------|------------|---------|------------|
|                                 | Pounds  | Percentage | Pounds  | Percentage | Pounds  | Percentage |
| Regular steel                   | 1,630.0 | 44.1%      | 1,655.0 | 42.4%      | 1,501.0 | 38.3%      |
| High and medium strength steel  | 324.0   | 8.8%       | 408.0   | 10.5%      | 524.0   | 13.4%      |
| Stainless steel                 | 51.0    | 1.4%       | 62.0    | 1.6%       | 69.0    | 1.8%       |
| Other steels                    | 46.0    | 1.2%       | 26.0    | 0.7%       | 31.0    | 0.8%       |
| Iron castings                   | 466.0   | 12.6%      | 432.0   | 11.1%      | 206.0   | 5.3%       |
| Aluminum                        | 231.0   | 6.3%       | 268.0   | 6.9%       | 324.0   | 8.3%       |
| Magnesium castings              | 4.0     | 0.1%       | 8.0     | 0.2%       | 12.0    | 0.3%       |
| Copper and brass                | 50.0    | 1.4%       | 52.0    | 1.3%       | 63.0    | 1.6%       |
| Lead                            | 33.0    | 0.9%       | 36.0    | 0.9%       | 45.0    | 1.1%       |
| Zinc castings                   | 19.0    | 0.5%       | 13.0    | 0.3%       | 9.0     | 0.2%       |
| Powder metal parts              | 29.0    | 0.8%       | 36.0    | 0.9%       | 41.0    | 1.0%       |
| Other metals                    | 4.0     | 0.1%       | 4.0     | 0.1%       | 5.0     | 0.1%       |
| Plastics and plastic composites | 240.0   | 6.5%       | 286.0   | 7.3%       | 384.0   | 9.8%       |
| Rubber                          | 149.0   | 4.0%       | 166.0   | 4.3%       | 212.0   | 5.4%       |
| Coatings                        | 23.0    | 0.6%       | 25.0    | 0.6%       | 34.0    | 0.9%       |
| Textiles                        | 42.0    | 1.10%      | 44.0    | 1.10%      | 53.0    | 1.4%       |
| Fluids and lubricants           | 192.0   | 5.20%      | 207.0   | 5.30%      | 219.0   | 5.6%       |
| Glass                           | 97.0    | 2.60%      | 103.0   | 2.60%      | 93.0    | 2.4%       |
| Other materials                 | 64.0    | 1.70%      | 71.0    | 1.80%      | 90.0    | 2.3%       |
| Total                           | 3,694.0 | 100.0%     | 3,902.0 | 100.0%     | 3,915.0 | 100.0%     |

**Source:**

Ward's Communications, *Ward's Motor Vehicle Facts and Figures, 2010*, Detroit, MI, 2010, p. 65 and updates.





*The number of franchised dealerships which sell new light-duty vehicles (cars and light trucks) has declined about 35% since 1970. The average number of vehicles sold per dealer in 2009 was 520 vehicles per dealer, down from a high of 779 vehicles per dealer in 2004.*

**Table 4.16**  
**New Light Vehicle Dealerships and Sales, 1970–2009**

| Calendar year                           | Number of franchised new light vehicle dealerships <sup>a</sup> | New light vehicle sales (thousands) | Light vehicle sales per dealer |
|---|---|-------------------------------------|--------------------------------|
| 1970                                    | 30,800  | 9,862                               | 320                            |
| 1975                                    | 29,600  | 10,905                              | 368                            |
| 1976                                    | 29,300  | 13,066                              | 446                            |
| 1977                                    | 29,100  | 14,613                              | 502                            |
| 1978                                    | 29,000  | 15,122                              | 521                            |
| 1979                                    | 28,500  | 13,984                              | 491                            |
| 1980                                    | 27,900  | 11,389                              | 408                            |
| 1981                                    | 26,350  | 10,678                              | 405                            |
| 1982                                    | 25,700  | 10,426                              | 406                            |
| 1983                                    | 24,725  | 12,132                              | 491                            |
| 1984                                    | 24,725  | 14,187                              | 574                            |
| 1985                                    | 24,725  | 15,437                              | 624                            |
| 1986                                    | 24,825  | 15,998                              | 644                            |
| 1987                                    | 25,150  | 14,802                              | 589                            |
| 1988                                    | 25,025  | 15,347                              | 613                            |
| 1989                                    | 25,000  | 14,389                              | 576                            |
| 1990                                    | 24,825  | 13,851                              | 558                            |
| 1991                                    | 24,200  | 12,312                              | 509                            |
| 1992                                    | 23,500  | 12,842                              | 546                            |
| 1993                                    | 22,950  | 13,869                              | 604                            |
| 1994                                    | 22,850  | 15,024                              | 658                            |
| 1995                                    | 22,800  | 14,688                              | 644                            |
| 1996                                    | 22,750  | 15,046                              | 661                            |
| 1997                                    | 22,700  | 15,069                              | 664                            |
| 1998                                    | 22,600  | 15,441                              | 683                            |
| 1999                                    | 22,400  | 16,771                              | 748                            |
| 2000                                    | 22,250  | 17,234                              | 774                            |
| 2001                                    | 22,150  | 17,123                              | 773                            |
| 2002                                    | 21,800  | 16,816                              | 771                            |
| 2003                                    | 21,725  | 16,548                              | 762                            |
| 2004                                    | 21,650  | 16,867                              | 779                            |
| 2005                                    | 21,640  | 16,948                              | 783                            |
| 2006                                    | 21,495  | 16,505                              | 768                            |
| 2007                                    | 21,200  | 16,089                              | 759                            |
| 2008                                    | 20,770  | 13,194                              | 635                            |
| 2009                                    | 20,010  | 10,402                              | 520                            |
| <i>Average annual percentage change</i> |   |                                     |                                |
| 1970–2009                               | -1.1%   | 0.1%                                | 1.3%                           |
| 1999–2009                               | -1.1%   | -4.7%                               | -3.6%                          |

**Source:**

Number of dealers - National Automobile Dealers Association website, [www.nada.org](http://www.nada.org). (Additional resources: <http://www.nada.org/Publications/NADADATA/>) Light-duty vehicle sales - See tables 4.5 and 4.6.

<sup>a</sup> As of the beginning of the year.



*The number of conventional refueling stations has been declining but rose in 2009. The number of vehicles fueling at those stations fell in 2009 for the first time in several years. In 2009, there were 0.65 fueling stations per thousand vehicles or 1.53 thousand vehicles per station.*

**Table 4.17**  
**Conventional Refueling Stations, 1993-2009**

| Year | Number of retail outlets | Vehicles in operation (thousands) | Stations per thousand vehicles | Thousand vehicles per station |
|------|--------------------------|-----------------------------------|--------------------------------|-------------------------------|
|      | Conventional fuels       |                                   |                                |                               |
| 1993 | 207,416                  | 186,315                           | 1.11                           | 0.90                          |
| 1994 | 202,878                  | 188,714                           | 1.08                           | 0.93                          |
| 1995 | 195,455                  | 193,441                           | 1.01                           | 0.99                          |
| 1996 | 190,246                  | 198,294                           | 0.96                           | 1.04                          |
| 1997 | 187,892                  | 201,071                           | 0.93                           | 1.07                          |
| 1998 | 182,596                  | 205,043                           | 0.89                           | 1.12                          |
| 1999 | 180,567                  | 209,509                           | 0.86                           | 1.16                          |
| 2000 | 175,941                  | 213,300                           | 0.82                           | 1.21                          |
| 2001 | 172,169                  | 216,683                           | 0.79                           | 1.26                          |
| 2002 | 170,018                  | 221,027                           | 0.77                           | 1.30                          |
| 2003 | 167,571                  | 225,882                           | 0.74                           | 1.35                          |
| 2004 | 167,346                  | 232,167                           | 0.72                           | 1.39                          |
| 2005 | 168,987                  | 238,384                           | 0.71                           | 1.41                          |
| 2006 | 167,476                  | 244,643                           | 0.69                           | 1.46                          |
| 2007 | 164,292                  | 248,701                           | 0.66                           | 1.51                          |
| 2008 | 161,068                  | 250,239                           | 0.64                           | 1.55                          |
| 2009 | 162,350                  | 248,460                           | 0.65                           | 1.53                          |

**Sources:**

Conventional refueling stations: National Petroleum News Survey, 2010.

Conventional vehicles: The Polk Company, Detroit, MI, **FURTHER REPRODUCTION PROHIBITED.**

**Notes:** The County Business Patterns (CBP) data published by the Bureau of the Census tells the number of establishments by North American Industry Classification System (NAICS). NAICS is an industry classification system that groups establishments into industries based on the activities in which they are primarily engaged. NAICS 447 represents gasoline stations. However, the CBP gasoline station data differ from the National Petroleum News Survey data by as much as 30% (117,189 stations in 2005); the CBP may not include every gasoline retail outlet due to the classification of the primary activity of the business.

Alternative Fuel Refueling Stations are listed in Chapter 6.



*The National Highway Traffic Safety Administration and the Environmental Protection Agency issued joint rulemaking to establish a new National Program to regulate fuel economy and greenhouse gas emissions for model year 2012-2016 cars and light trucks.*

**Table 4.18**  
**Fuel Economy and Carbon Dioxide Emissions Standards, MY 2012-2016**

| Year  | Cars | Light Trucks | Combined Cars and<br>Light Trucks |
|---|------|--------------|-----------------------------------|
| Average Required Fuel Economy<br>(miles per gallon)   |      |              |                                   |
| 2012  | 33.3 | 25.4         | 29.7                              |
| 2013  | 34.2 | 26.0         | 30.5                              |
| 2014  | 34.9 | 26.6         | 31.3                              |
| 2015  | 36.2 | 27.5         | 32.6                              |
| 2016  | 37.8 | 28.8         | 34.1                              |
| Average Projected Emissions Compliance Levels under<br>the Footprint-based Carbon Dioxide Standards<br>(grams per mile) |      |              |                                   |
| 2012  | 263  | 346          | 295                               |
| 2013  | 256  | 337          | 286                               |
| 2014  | 247  | 326          | 276                               |
| 2015  | 236  | 312          | 263                               |
| 2016  | 225  | 298          | 250                               |

**Source:**

Federal Register, Vol. 75, No. 88, May 7, 2010. (Additional resources:  
[www.nhtsa.dot.gov/portal/fueleconomy.jsp](http://www.nhtsa.dot.gov/portal/fueleconomy.jsp))

**Note:** The required fuel economy, along with projections of CO<sub>2</sub> emissions, are shown here.



*The target levels for the proposed fuel economy and carbon dioxide emission standards for vehicles manufactured in model years 2012-2016 are assigned based on a vehicle's "footprint." Each footprint has a different target. The vehicle footprint is calculated as:*

$$\text{footprint} = \text{track width} \times \text{wheelbase},$$

*where*

*track width = lateral distance between the centerlines of the base tires at ground, and*

*wheelbase = longitudinal distance between the front and rear wheel centerlines.*

**Table 4.19**  
**Fuel Economy and Carbon Dioxide Targets for Model Year 2016**

| Vehicle type              | Example models  | Example model footprint (square feet) | CO <sub>2</sub> emissions target (grams per mile) | Fuel economy target (miles per gallon) |
|---------------------------|-----------------|---------------------------------------|---|--|
| Example Passenger Cars    |                 |                                       |   |  |
| Compact car               | Honda Fit       | 40                                    | 214   | 41.4                                   |
| Midsized car              | Ford Fusion     | 46                                    | 237   | 37.3                                   |
| Fullsize car              | Chrysler 300    | 53                                    | 270   | 32.8                                   |
| Example Light-Duty Trucks |                 |                                       |   |  |
| Small SUV                 | 4WD Ford Escape | 44                                    | 269   | 32.8                                   |
| Midsized crossover        | Nissan Murano   | 49                                    | 289   | 30.6                                   |
| Minivan                   | Toyota Sienna   | 55                                    | 313   | 28.2                                   |
| Large pickup truck        | Chevy Silverado | 67                                    | 358   | 24.7                                   |

**Source:**

Federal Register, Vol. 75, No. 88, May 7, 2010.

**Note:** Examples use model year 2008 vehicle specifications.



*The Corporate Average Fuel Economy standards were established by the U.S. Energy Policy and Conservation Act of 1975 (PL94-163). These standards must be met at the manufacturer level. Some manufacturers fall short of meeting the standards while others exceed them. Legislation passed in December 2007 changed the CAFE standards beginning in the 2011 model year. The new standards have a target of combined fleet fuel economy of 35 mpg by 2020, for all cars and light trucks.*

**Table 4.20**  
**Car Corporate Average Fuel Economy (CAFE)**  
**Standards versus Sales-Weighted Fuel Economy Estimates, 1978–2011<sup>a</sup>**  
**(miles per gallon)**

| Model<br>year <sup>b</sup> | Cars              |                             |        |          | CAFE estimates                    |
|----------------------------|-------------------|-----------------------------|--------|----------|-----------------------------------|
|                            | CAFE<br>standards | CAFE estimates <sup>c</sup> |        |          | Cars and light<br>trucks combined |
|                            |                   | Domestic                    | Import | Combined |                                   |
| 1978                       | 18.0              | 18.7                        | 27.3   | 19.9     | 19.9                              |
| 1979                       | 19.0              | 19.3                        | 26.1   | 20.3     | 20.1                              |
| 1980                       | 20.0              | 22.6                        | 29.6   | 24.3     | 23.1                              |
| 1981                       | 22.0              | 24.2                        | 31.5   | 25.9     | 24.6                              |
| 1982                       | 24.0              | 25.0                        | 31.1   | 26.6     | 25.1                              |
| 1983                       | 26.0              | 24.4                        | 32.4   | 26.4     | 24.8                              |
| 1984                       | 27.0              | 25.5                        | 32.0   | 26.9     | 25.0                              |
| 1985                       | 27.5              | 26.3                        | 31.5   | 27.6     | 25.4                              |
| 1986                       | 26.0              | 26.9                        | 31.6   | 28.2     | 25.9                              |
| 1987                       | 26.0              | 27.0                        | 31.2   | 28.5     | 26.2                              |
| 1988                       | 26.0              | 27.4                        | 31.5   | 28.8     | 26.0                              |
| 1989                       | 26.5              | 27.2                        | 30.8   | 28.4     | 25.6                              |
| 1990                       | 27.5              | 26.9                        | 29.9   | 28.0     | 25.4                              |
| 1991                       | 27.5              | 27.3                        | 30.1   | 28.4     | 25.6                              |
| 1992                       | 27.5              | 27.0                        | 29.2   | 27.9     | 25.1                              |
| 1993                       | 27.5              | 27.8                        | 29.6   | 28.4     | 25.2                              |
| 1994                       | 27.5              | 27.5                        | 29.6   | 28.3     | 24.7                              |
| 1995                       | 27.5              | 27.7                        | 30.3   | 28.6     | 24.9                              |
| 1996                       | 27.5              | 28.1                        | 29.6   | 28.5     | 24.9                              |
| 1997                       | 27.5              | 27.8                        | 30.1   | 28.7     | 24.6                              |
| 1998                       | 27.5              | 28.6                        | 29.2   | 28.8     | 24.7                              |
| 1999                       | 27.5              | 28.0                        | 29.0   | 28.3     | 24.5                              |
| 2000                       | 27.5              | 28.7                        | 28.3   | 28.5     | 24.8                              |
| 2001                       | 27.5              | 28.7                        | 29.0   | 28.8     | 24.5                              |
| 2002                       | 27.5              | 29.1                        | 28.8   | 29.0     | 24.7                              |
| 2003                       | 27.5              | 29.1                        | 29.9   | 29.5     | 25.1                              |
| 2004                       | 27.5              | 29.9                        | 28.7   | 29.5     | 24.6                              |
| 2005                       | 27.5              | 30.5                        | 29.9   | 30.3     | 25.4                              |
| 2006                       | 27.5              | 30.3                        | 29.7   | 30.1     | 25.8                              |
| 2007                       | 27.5              | 30.6                        | 32.2   | 31.2     | 26.6                              |
| 2008                       | 27.5              | 31.2                        | 31.8   | 31.5     | 27.1                              |
| 2009                       | 27.5              | 32.1                        | 33.8   | 32.9     | 29.0                              |
| 2010                       | 27.5              | 32.9                        | 35.1   | 33.7     | 29.2                              |
| 2011                       | 30.2 <sup>d</sup> | 32.3                        | 34.7   | 34.4     | 29.3                              |

**Source:**

U.S. Department of Transportation, NHTSA, "Summary of Fuel Economy Performance," Washington, DC, April 2011. (Additional resources: [www.nhtsa.dot.gov](http://www.nhtsa.dot.gov))

<sup>a</sup> Only vehicles with at least 75 percent domestic content can be counted in the average domestic fuel economy for a manufacturer.

<sup>b</sup> Model year as determined by the manufacturer on a vehicle by vehicle basis.

<sup>c</sup> All CAFE calculations are sales-weighted.

<sup>d</sup> Projected 2011 required average fuel economy standards value based on pre-model year reports.



*The Corporate Average Fuel Economy standards for light trucks are lower than the car standards. Light trucks include pickups, minivans, sport utility vehicles and vans. New legislation passed in December 2007 changed the CAFE standards beginning in the 2011 model year. The new standards have a target of combined fleet fuel economy of 35 mpg by 2020, for all cars and light trucks.*

**Table 4.21**  
**Light Truck Corporate Average Fuel Economy (CAFE)**  
**Standards versus Sales-Weighted Fuel Economy Estimates, 1978–2011<sup>a</sup>**  
**(miles per gallon)**

| Model<br>year <sup>c</sup> | Light trucks <sup>b</sup> |                             |              |          | CAFE estimates                    |
|----------------------------|---------------------------|-----------------------------|--------------|----------|-----------------------------------|
|                            | CAFE<br>standards         | CAFE estimates <sup>d</sup> |              |          | Cars and light<br>trucks combined |
|                            |                           | Domestic                    | Import       | Combined |                                   |
| 1978                       | <sup>e</sup>              |                             |              |          | 19.9                              |
| 1980                       | <sup>e</sup>              | 16.8                        | 24.3         | 18.5     | 23.1                              |
| 1985                       | 19.5                      | 19.6                        | 26.5         | 20.7     | 25.4                              |
| 1986                       | 20.0                      | 20.0                        | 25.9         | 21.5     | 25.9                              |
| 1987                       | 20.5                      | 20.5                        | 25.2         | 21.7     | 26.2                              |
| 1988                       | 20.5                      | 20.6                        | 24.6         | 21.3     | 26.0                              |
| 1989                       | 20.5                      | 20.4                        | 23.5         | 21.0     | 25.6                              |
| 1990                       | 20.0                      | 20.3                        | 23.0         | 20.8     | 25.4                              |
| 1991                       | 20.2                      | 20.9                        | 23.0         | 21.3     | 25.6                              |
| 1992                       | 20.2                      | 20.5                        | 22.7         | 20.8     | 25.1                              |
| 1993                       | 20.4                      | 20.7                        | 22.8         | 21.0     | 25.2                              |
| 1994                       | 20.5                      | 20.5                        | 22.1         | 20.8     | 24.7                              |
| 1995                       | 20.6                      | 20.3                        | 21.5         | 20.5     | 24.9                              |
| 1996                       | 20.7                      | 20.5                        | 22.2         | 20.8     | 24.9                              |
| 1997                       | 20.7                      | 20.1                        | 22.1         | 20.6     | 24.6                              |
| 1998                       | 20.7                      | 20.5                        | 23.0         | 21.0     | 24.7                              |
| 1999                       | 20.7                      | 20.4                        | 22.5         | 20.9     | 24.5                              |
| 2000                       | 20.7                      | 21.1                        | 19.7         | 21.3     | 24.8                              |
| 2001                       | 20.7                      | 20.6                        | 21.8         | 20.9     | 24.5                              |
| 2002                       | 20.7                      | 20.6                        | 21.9         | 21.4     | 24.7                              |
| 2003                       | 20.7                      | 21.8                        | 22.4         | 21.8     | 25.1                              |
| 2004                       | 20.7                      | 20.7                        | 22.3         | 21.5     | 24.6                              |
| 2005                       | 21.0                      | <sup>f</sup>                | <sup>f</sup> | 22.1     | 25.4                              |
| 2006                       | 21.6                      | <sup>f</sup>                | <sup>f</sup> | 22.5     | 25.8                              |
| 2007                       | 22.2                      | <sup>f</sup>                | <sup>f</sup> | 23.1     | 26.6                              |
| 2008                       | 22.5 <sup>g</sup>         | <sup>f</sup>                | <sup>f</sup> | 23.6     | 27.1                              |
| 2009                       | 23.1 <sup>g</sup>         | <sup>f</sup>                | <sup>f</sup> | 24.8     | 29.2                              |
| 2010                       | 23.5 <sup>g</sup>         | <sup>f</sup>                | <sup>f</sup> | 25.1     | 29.2                              |
| 2011                       | 24.2 <sup>h</sup>         | <sup>f</sup>                | <sup>f</sup> | 24.8     | 29.3                              |

**Source:**

U.S. Department of Transportation, NHTSA, "Summary of Fuel Economy Performance," Washington, DC, April 2011. (Additional resources: [www.nhtsa.dot.gov](http://www.nhtsa.dot.gov))

<sup>a</sup> Only vehicles with at least 75% domestic content can be counted in the average domestic fuel economy for a manufacturer.

<sup>b</sup> Represents two- and four-wheel drive trucks combined. Gross vehicle weight of 0-6,000 pounds for model year 1978-1979 and 0-8,500 pounds for subsequent years.

<sup>c</sup> Model year as determined by the manufacturer on a vehicle by vehicle basis.

<sup>d</sup> All CAFE calculations are sales-weighted.

<sup>e</sup> Standards were set for two-wheel drive and four-wheel drive light trucks, but no combined standard was set in this year.

<sup>f</sup> Data are not available.

<sup>g</sup> Unreformed standards. See Table 4.18 for reformed standards.

<sup>h</sup> Projected 2011 required average fuel economy standards value based on pre-model year reports.



*Manufacturers of cars and light trucks whose vehicles do not meet the CAFE standards are fined. Data from the National Highway Traffic Safety Administration show CAFE fine collection dropped under \$25 million in 2002 and 2003; this was due to several factors, including the CAFE credit system, manufacturer mergers, and fines not being paid in the same year they were assessed. Fines for the 2008 and 2009 model years are still being collected.*

**Table 4.22**  
**Corporate Average Fuel Economy (CAFE) Fines Collected, 1983-2009<sup>a</sup>**  
(thousands)

| Model year | Current dollars | 2009 constant dollars <sup>b</sup> |
|------------|-----------------|------------------------------------|
| 1983       | 58              | 125                                |
| 1984       | 5,958           | 12,303                             |
| 1985       | 15,565          | 31,034                             |
| 1986       | 29,872          | 58,473                             |
| 1987       | 31,261          | 59,036                             |
| 1988       | 44,519          | 80,736                             |
| 1989       | 47,501          | 82,182                             |
| 1990       | 48,309          | 79,296                             |
| 1991       | 42,243          | 66,539                             |
| 1992       | 38,287          | 58,545                             |
| 1993       | 28,688          | 42,593                             |
| 1994       | 31,499          | 45,598                             |
| 1995       | 40,787          | 57,418                             |
| 1996       | 19,302          | 26,392                             |
| 1997       | 36,212          | 48,404                             |
| 1998       | 21,740          | 28,613                             |
| 1999       | 27,516          | 35,434                             |
| 2000       | 51,067          | 63,622                             |
| 2001       | 35,507          | 43,013                             |
| 2002       | 20,042          | 23,900                             |
| 2003       | 15,225          | 17,752                             |
| 2004       | 33,637          | 38,203                             |
| 2005       | 27,487          | 30,194                             |
| 2006       | 43,183          | 45,955                             |
| 2007       | 37,386          | 38,683                             |
| 2008       | 12,922          | 12,876                             |
| 2009       | 9,148           | 9,148                              |

**Source:**

U.S. Department of Transportation, National Highway Traffic Safety Administration, Office of Vehicle Safety Compliance, Washington, DC, February 2011. (Additional resources: [www.nhtsa.dot.gov](http://www.nhtsa.dot.gov))

<sup>a</sup> These are fines which are actually collected. Fines which are assessed in certain year may not have been collected in that year.

<sup>b</sup> Adjusted using the Consumer Price Inflation Index.



*Consumers must pay the Gas Guzzler Tax when purchasing a car that has an Environmental Protection Agency (EPA) fuel economy rating (combined city and highway) less than that stipulated in the table below. The Gas Guzzler Tax doubled in 1991 after remaining constant from 1986 to 1990. The tax has not changed since 1991. This tax does not apply to light trucks such as pickups, minivans, sport utility vehicles, and vans.*

**Table 4.23**  
**The Gas Guzzler Tax on New Cars**  
**(dollars per vehicle)**

| Vehicle fuel economy (mpg) | 1980 | 1981 | 1982  | 1983  | 1984  | 1985  | 1986-90 | 1991 - on |
|----------------------------|------|------|-------|-------|-------|-------|---------|-----------|
| Over 22.5                  | 0    | 0    | 0     | 0     | 0     | 0     | 0       | 0         |
| 22.0-22.5                  | 0    | 0    | 0     | 0     | 0     | 0     | 500     | 1,000     |
| 21.5-22.0                  | 0    | 0    | 0     | 0     | 0     | 0     | 500     | 1,000     |
| 21.0-21.5                  | 0    | 0    | 0     | 0     | 0     | 0     | 650     | 1,300     |
| 20.5-21.0                  | 0    | 0    | 0     | 0     | 0     | 500   | 650     | 1,300     |
| 20.0-20.5                  | 0    | 0    | 0     | 0     | 0     | 500   | 850     | 1,700     |
| 19.5-20.0                  | 0    | 0    | 0     | 0     | 0     | 600   | 850     | 1,700     |
| 19.0-19.5                  | 0    | 0    | 0     | 0     | 450   | 600   | 1,050   | 2,100     |
| 18.5-19.0                  | 0    | 0    | 0     | 350   | 450   | 800   | 1,050   | 2,100     |
| 18.0-18.5                  | 0    | 0    | 200   | 350   | 600   | 800   | 1,300   | 2,600     |
| 17.5-18.0                  | 0    | 0    | 200   | 500   | 600   | 1,000 | 1,300   | 2,600     |
| 17.0-17.5                  | 0    | 0    | 350   | 500   | 750   | 1,000 | 1,500   | 3,000     |
| 16.5-17.0                  | 0    | 200  | 350   | 650   | 750   | 1,200 | 1,500   | 3,000     |
| 16.0-16.5                  | 0    | 200  | 450   | 650   | 950   | 1,200 | 1,850   | 3,700     |
| 15.5-16.0                  | 0    | 350  | 450   | 800   | 950   | 1,500 | 1,850   | 3,700     |
| 15.0-15.5                  | 0    | 350  | 600   | 800   | 1,150 | 1,500 | 2,250   | 4,500     |
| 14.5-15.0                  | 200  | 450  | 600   | 1,000 | 1,150 | 1,800 | 2,250   | 4,500     |
| 14.0-14.5                  | 200  | 450  | 750   | 1,000 | 1,450 | 1,800 | 2,700   | 5,400     |
| 13.5-14.0                  | 300  | 550  | 750   | 1,250 | 1,450 | 2,200 | 2,700   | 5,400     |
| 13.0-13.5                  | 300  | 550  | 950   | 1,250 | 1,750 | 2,200 | 3,200   | 6,400     |
| 12.5-13.0                  | 550  | 650  | 950   | 1,550 | 1,750 | 2,650 | 3,200   | 6,400     |
| Under 12.5                 | 550  | 650  | 1,200 | 1,550 | 2,150 | 2,650 | 3,850   | 7,700     |

**Source:**

Internal Revenue Service, Form 6197, (Rev. 10-05), "Gas Guzzler Tax." (Additional resources: [www.irs.ustreas.gov](http://www.irs.ustreas.gov))





*Consumers continue to demand gas guzzling cars though fewer gas guzzlers were bought in model year 2009 than in the previous six years. The IRS collected over \$99 million in 2009 from those buying cars with combined city/highway fuel economy less than 22.5 miles per gallon. This tax does not apply to light trucks such as pickups, minivans, sport utility vehicles, and vans. It is worthy to note that total revenue from fines paid by consumers to purchase gas-guzzling vehicles greatly exceeds the overall fines paid by manufacturers whose vehicles fail to meet CAFE standards (see Table 4.23).*

**Table 4.24**  
**Tax Receipts from the Sale of Gas Guzzlers, 1980–2009**  
**(thousands)**

| Model year | Current dollars | 2009<br>constant dollars <sup>a</sup> |
|------------|-----------------|---------------------------------------|
| 1980       | 740             | 1,927                                 |
| 1981       | 780             | 1,841                                 |
| 1982       | 1,720           | 3,824                                 |
| 1983       | 4,020           | 8,659                                 |
| 1984       | 8,820           | 18,212                                |
| 1985       | 39,790          | 79,335                                |
| 1986       | 147,660         | 289,038                               |
| 1987       | 145,900         | 275,537                               |
| 1988       | 116,780         | 211,780                               |
| 1989       | 109,640         | 189,692                               |
| 1990       | 103,200         | 169,397                               |
| 1991       | 118,400         | 186,499                               |
| 1992       | 144,200         | 220,501                               |
| 1993       | 111,600         | 165,691                               |
| 1994       | 64,100          | 92,792                                |
| 1995       | 73,500          | 103,468                               |
| 1996       | 52,600          | 71,923                                |
| 1997       | 48,200          | 64,428                                |
| 1998       | 47,700          | 62,782                                |
| 1999       | 68,300          | 87,952                                |
| 2000       | 70,800          | 88,207                                |
| 2001       | 78,200          | 94,731                                |
| 2002       | 79,700          | 95,045                                |
| 2003       | 126,700         | 147,727                               |
| 2004       | 140,800         | 159,909                               |
| 2005       | 163,800         | 179,934                               |
| 2006       | 200,200         | 213,047                               |
| 2007       | 178,700         | 184,901                               |
| 2008       | 172,428         | 171,815                               |
| 2009       | 99,300          | 99,300                                |

**Source:**

Ward's Communications, Detroit, MI, 2011. Original data source: Internal Revenue Service.

<sup>a</sup> Adjusted using the Consumer Price Inflation Index.



*The Powertrain System Analysis Toolkit (PSAT) provides vehicle simulations for a variety of research purposes. It is used by the Department of Energy to evaluate the fuel efficiency potential of advanced powertrain configurations for different driving conditions. Recently, PSAT was used to develop data on the relationship between speed and fuel economy.*

**Table 4.25**  
**Fuel Economy by Speed, PSAT Model Results**

| Speed (mph)              | Gasoline Conventional |           |           | Diesel Conventional |           |           | Hybrid Vehicles           |            |                         |                         |
|--------------------------|-----------------------|-----------|-----------|---------------------|-----------|-----------|---------------------------|------------|-------------------------|-------------------------|
|                          | Midsize Car           | Small SUV | Large SUV | Midsize Car         | Small SUV | Large SUV | 2000 Insight <sup>a</sup> | 2004 Prius | 2007 Camry <sup>a</sup> | 2008 Tahoe <sup>a</sup> |
| 45                       | 39.1                  | 32.5      | 29.5      | 56.4                | 47.7      | 43.6      | 101.3                     | 72.0       | 52.2                    | 32.2                    |
| 55                       | 41.7                  | 34.3      | 30.0      | 57.0                | 46.0      | 39.9      | 94.3                      | 66.0       | 46.8                    | 27.1                    |
| 65                       | 36.9                  | 29.1      | 23.0      | 47.9                | 37.6      | 32.5      | 80.0                      | 57.0       | 40.9                    | 23.7                    |
| 75                       | 31.9                  | 24.5      | 19.8      | 40.2                | 30.8      | 26.9      | 60.6                      | 42.0       | 35.0                    | 21.1                    |
| <i>Fuel economy loss</i> |                       |           |           |                     |           |           |                           |            |                         |                         |
| 55 - 65 mph              | 11.5%                 | 15.2%     | 23.5%     | 16.0%               | 18.3%     | 18.5%     | 15.2%                     | 13.6%      | 12.6%                   | 12.4%                   |
| 65 - 75 mph              | 13.6%                 | 15.8%     | 13.8%     | 16.2%               | 18.1%     | 17.2%     | 24.3%                     | 26.3%      | 14.5%                   | 11.1%                   |
| 55 - 75 mph              | 23.5%                 | 28.6%     | 34.0%     | 29.6%               | 33.1%     | 32.6%     | 35.8%                     | 36.4%      | 25.3%                   | 22.1%                   |

**Source:**

Argonne National Laboratory, Powertrain System Analysis Toolkit, July 16, 2009,  
[www.transportation.anl.gov/modeling\\_simulation/PSAT/](http://www.transportation.anl.gov/modeling_simulation/PSAT/). (Additional resources: [www.transportation.anl.gov](http://www.transportation.anl.gov))

<sup>a</sup> From Argonne National Laboratory Advanced Powertrain Research Facility (Vehicle Test Data).



*The two earlier studies by the Federal Highway Administration (FHWA) indicate maximum fuel efficiency was achieved at speeds of 35 to 40 mph. The recent FHWA study indicates greater fuel efficiency at higher speeds. Note that the 1973 study did not include light trucks.*

**Table 4.26**  
**Fuel Economy by Speed, 1973, 1984, and 1997 Studies**  
(miles per gallon)

| Speed<br>(miles per hour) | 1973 <sup>a</sup><br>(13 vehicles) | 1984 <sup>b</sup><br>(15 vehicles) | 1997 <sup>c</sup><br>(9 vehicles) |
|---------------------------|------------------------------------|------------------------------------|-----------------------------------|
| 15                        | d                                  | 21.1                               | 24.4                              |
| 20                        | d                                  | 25.5                               | 27.9                              |
| 25                        | d                                  | 30.0                               | 30.5                              |
| 30                        | 21.1                               | 31.8                               | 31.7                              |
| 35                        | 21.1                               | 33.6                               | 31.2                              |
| 40                        | 21.1                               | 33.6                               | 31.0                              |
| 45                        | 20.3                               | 33.5                               | 31.6                              |
| 50                        | 19.5                               | 31.9                               | 32.4                              |
| 55                        | 18.5                               | 30.3                               | 32.4                              |
| 60                        | 17.5                               | 27.6                               | 31.4                              |
| 65                        | 16.2                               | 24.9                               | 29.2                              |
| 70                        | 14.9                               | 22.5                               | 26.8                              |
| 75                        | d                                  | 20.0                               | 24.8                              |
| <i>Fuel economy loss</i>  |                                    |                                    |                                   |
| 55–65 mph                 | 12.4%                              | 17.8%                              | 9.7%                              |
| 65–70 mph                 | 8.0%                               | 9.6%                               | 8.2%                              |
| 55–70 mph                 | 19.5%                              | 25.7%                              | 17.1%                             |

**Sources:**

1973- U.S. Department of Transportation, Federal Highway Administration, Office of Highway Planning, *The Effect of Speed on Automobile Gasoline Consumption Rates*, Washington, DC, October 1973.

1984 - U.S. Department of Transportation, Federal Highway Administration, *Fuel Consumption and Emission Values for Traffic Models*, Washington, DC, May 1985.

1997 - West, B.H., R.N. McGill, J.W. Hodgson, S.S. Sluder, and D.E. Smith, *Development and Verification of Light-Duty Modal Emissions and Fuel Consumption Values for Traffic Models*, FHWA-RD-99-068, U.S. Department of Transportation, Federal Highway Administration, Washington, DC, March 1999. (Additional resources: [www.fhwa-tsiss.com](http://www.fhwa-tsiss.com))

<sup>a</sup> Model years 1970 and earlier cars.

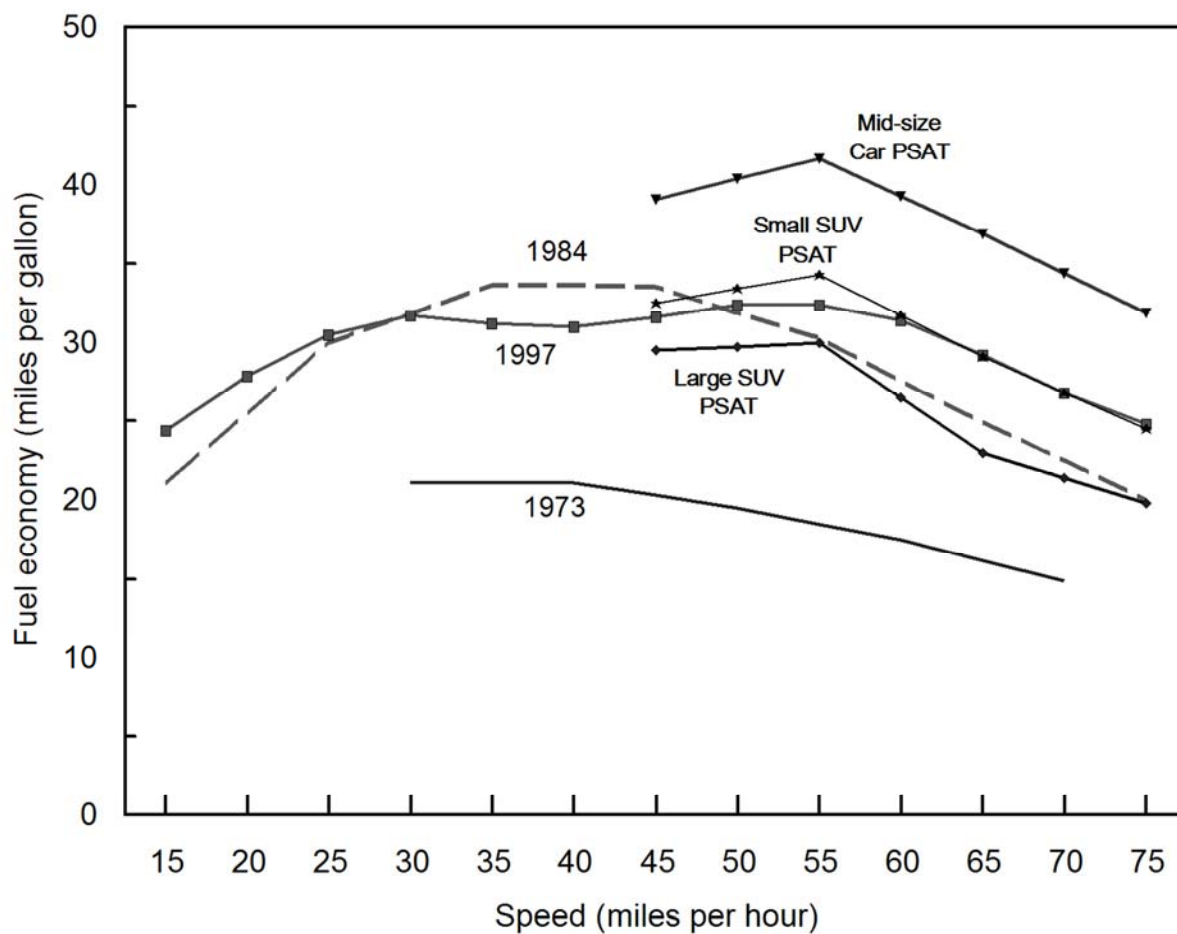
<sup>b</sup> Model years 1981–84 cars and light trucks.

<sup>c</sup> Model years 1988–97 cars and light trucks.

<sup>d</sup> Data are not available.



**Figure 4.2. Fuel Economy by Speed, 1973, 1984, and 1997 Studies**



**Source:**

See Tables 4.25 and 4.26.



*Of the tested vehicles, the 1994 Oldsmobile Olds 88 had the greatest fuel economy loss from 55 mph to 75 mpg. The 1997 Toyota Celica tested fuel economy was slightly better at 65 mph than at 55 mph.*

**Table 4.27**  
**Steady Speed Fuel Economy for Vehicles Tested in the 1997 Study**  
**(miles per gallon)**

| Speed<br>(mph)           | 1988<br>Chevrolet<br>Corsica | 1993<br>Subaru<br>Legacy | 1994<br>Oldsmobile<br>Olds 88 | 1994<br>Oldsmobile<br>Cutlass | 1994<br>Chevrolet<br>Pickup | 1994 Jeep<br>Grand<br>Cherokee | 1994<br>Mercury<br>Villager | 1995<br>Geo<br>Prizm | 1997<br>Toyota<br>Celica |
|--------------------------|------------------------------|--------------------------|-------------------------------|-------------------------------|-----------------------------|--------------------------------|-----------------------------|----------------------|--------------------------|
| 5                        | 10.0                         | 14.5                     | 10.5                          | 5.1                           | 7.9                         | 8.2                            | 12.3                        | 18.1                 | 19.1                     |
| 10                       | 16.8                         | 24.7                     | 14.9                          | 7.9                           | 16.0                        | 11.2                           | 19.0                        | 23.1                 | 34.1                     |
| 15                       | 17.7                         | 31.9                     | 22.2                          | 11.4                          | 16.3                        | 17.5                           | 22.4                        | 38.9                 | 41.7                     |
| 20                       | 21.7                         | 34.4                     | 26.3                          | 12.5                          | 19.9                        | 24.7                           | 25.8                        | 39.4                 | 46.0                     |
| 25                       | 23.9                         | 37.4                     | 28.3                          | 15.6                          | 22.7                        | 21.8                           | 30.8                        | 41.7                 | 52.6                     |
| 30                       | 28.7                         | 39.7                     | 29.0                          | 19.0                          | 26.3                        | 21.6                           | 30.3                        | 40.0                 | 50.8                     |
| 35                       | 28.6                         | 38.0                     | 30.9                          | 21.2                          | 24.3                        | 25.0                           | 26.1                        | 39.1                 | 47.6                     |
| 40                       | 29.2                         | 37.0                     | 33.2                          | 23.0                          | 26.7                        | 25.5                           | 29.0                        | 38.9                 | 36.2                     |
| 45                       | 28.8                         | 33.7                     | 32.4                          | 23.0                          | 27.3                        | 25.4                           | 27.8                        | 42.3                 | 44.1                     |
| 50                       | 31.2                         | 33.7                     | 34.2                          | 27.3                          | 26.3                        | 24.8                           | 30.1                        | 39.1                 | 44.8                     |
| 55                       | 29.1                         | 37.7                     | 34.6                          | 29.1                          | 25.1                        | 24.0                           | 31.7                        | 37.7                 | 42.5                     |
| 60                       | 28.2                         | 35.9                     | 32.5                          | 28.2                          | 22.6                        | 23.2                           | 27.3                        | 36.7                 | 48.4                     |
| 65                       | 28.7                         | 33.4                     | 30.0                          | 25.0                          | 21.8                        | 21.3                           | 25.3                        | 34.1                 | 43.5                     |
| 70                       | 26.1                         | 31.0                     | 26.7                          | 22.9                          | 20.1                        | 20.0                           | 23.9                        | 31.7                 | 39.2                     |
| 75                       | 23.7                         | 28.8                     | 24.0                          | 21.6                          | 18.1                        | 19.1                           | 22.4                        | 28.3                 | 36.8                     |
| <i>Fuel economy loss</i> |                              |                          |                               |                               |                             |                                |                             |                      |                          |
| 55–65 mph                | 1.4%                         | 11.4%                    | 13.3%                         | 14.1%                         | 13.1%                       | 11.3%                          | 20.2%                       | 9.5%                 | -2.4%                    |
| 65–75 mph                | 17.4%                        | 13.8%                    | 20.0%                         | 13.6%                         | 17.0%                       | 10.3%                          | 11.5%                       | 17.0%                | 15.4%                    |
| 55–75 mph                | 18.6%                        | 23.6%                    | 30.6%                         | 25.8%                         | 27.9%                       | 20.4%                          | 29.3%                       | 24.9%                | 13.4%                    |

**Source:**

B.H. West, R.N. McGill, J.W. Hodgson, S.S. Sluder, D.E. Smith, *Development and Verification of Light-Duty Modal Emissions and Fuel Consumption Values for Traffic Models*, Washington, DC, April 1997, and additional project data, April 1998. (Additional resources: [www.fhwa-tsis.com](http://www.fhwa-tsis.com))

**Note:** For specifications of the tested vehicles, please see Table 4.26.



*This table shows the new methodology that the Environmental Protection Agency (EPA) used to determine fuel economy ratings for new vehicles beginning in model year 2008. In addition to the Urban Driving Cycle and the Highway Driving cycle, the EPA will also use three additional tests to adjust fuel economy ratings to account for higher speeds, air conditioner use, and colder temperatures. Though the EPA uses a complex combination of these five cycles to determine the fuel economy that will be posted on a new vehicle window sticker, the manufacturer's Corporate Average Fuel Economy is still calculated using only the city and highway driving cycles. To know more about new vehicle fuel economy ratings, visit [www.fueleconomy.gov](http://www.fueleconomy.gov).*

**Table 4.28**  
**Driving Cycle Attributes**

|                             | Test Schedule                           |                                     |  |                                     |  |
|-----------------------------|---|-------------------------------------|--|-------------------------------------|--|
|                             | City                                    | Highway                             | High Speed                                   | AC                                  | Cold Temp                              |
| Trip type                   | Low speeds in stop-and-go urban traffic | Free-flow traffic at highway speeds | Higher speeds; harder acceleration & braking | AC use under hot ambient conditions | City test w/colder outside temperature |
| Top speed                   | 56 mph                                  | 60 mph                              | <b>80 mph</b>                                | 54.8 mph                            | 56 mph                                 |
| Average speed               | 20 mph                                  | 48 mph                              | 48 mph                                       | 22 mph                              | 20 mph                                 |
| Max. acceleration           | 3.3 mph/sec                             | 3.2 mph/sec                         | <b>8.46 mph/sec</b>                          | 5.1 mph/sec                         | 3.3 mph/sec                            |
| Simulated distance          | 11 mi.                                  | 10 mi.                              | 8 mi.  | 3.6 mi.                             | 11 mi.                                 |
| Time                        | 31 min.                                 | 12.5 min.                           | 10 min.                                      | 9.9 min.                            | 31 min.                                |
| Stops                       | 23                                      | None                                | 4  | 5                                   | 23                                     |
| Idling time                 | 18% of time                             | None                                | 7% of time                                   | 19% of time                         | 18% of time                            |
| Engine startup <sup>a</sup> | Cold                                    | Warm                                | Warm   | Warm                                | <b>Cold</b>                            |
| Lab temperature             | 68-86° F                                | 68-86° F                            | 68-86° F                                     | <b>95° F</b>                        | <b>20° F</b>                           |
| Vehicle air conditioning    | Off                                     | Off                                 | Off  | <b>On</b>                           | Off                                    |

**Source:**

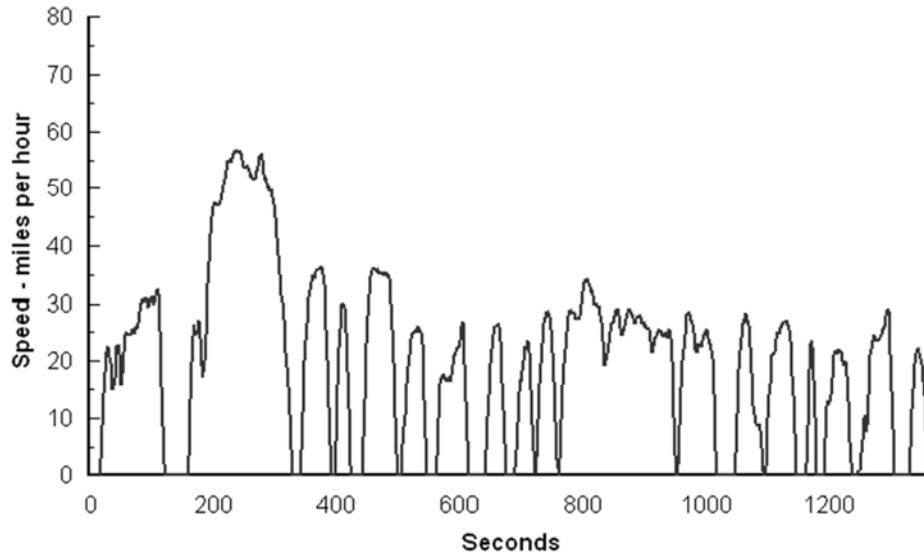
U.S. Department of Energy and U.S. Environmental Protection Agency, Fuel Economy Web site, [www.fueleconomy.gov](http://www.fueleconomy.gov).

<sup>a</sup> A vehicle's engine doesn't reach maximum fuel efficiency until it is warm.

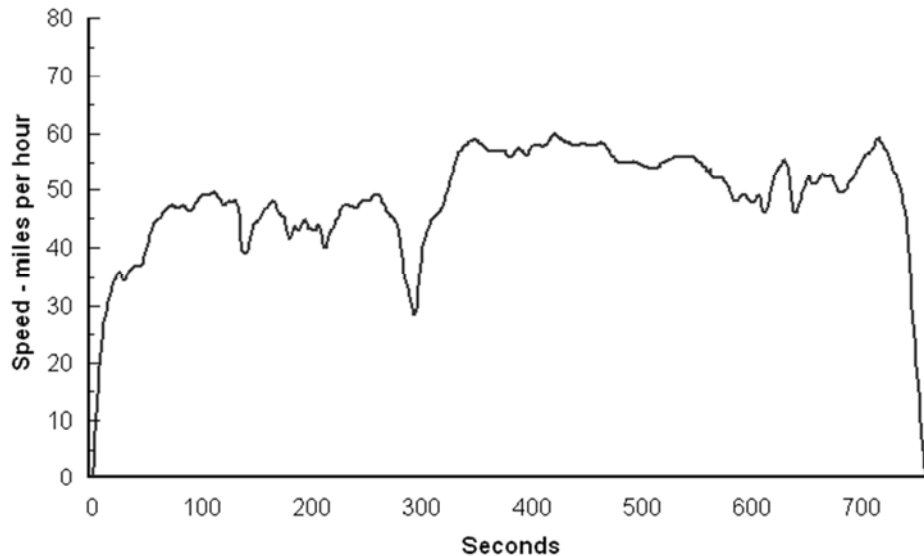


*These driving cycles simulate the performance of an engine while driving in the city and on the highway. Once the city cycle is completed, the engine is stopped, and then started again for the 8.5 minute hot start cycle. Three additional cycles also influence new vehicle fuel economy ratings beginning with the 2008 model year.*

**Figure 4.3. City Driving Cycle**



**Figure 4.4. Highway Driving Cycle**



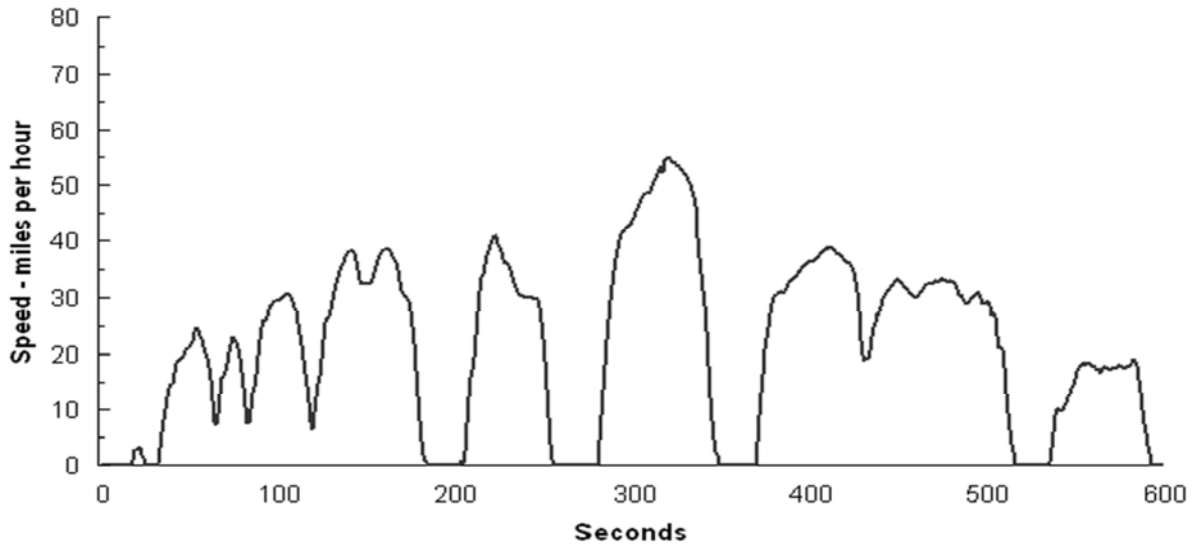
**Source:**

*Code of Federal Regulations, 40CFR, "Subpart B - Fuel Economy Regulations for 1978 and Later Model Year Automobiles - Test Procedures," July 1, 1988 edition, p. 676.*



*Beginning with the 2008 model year, these cycles influence the new vehicle fuel economy ratings.*

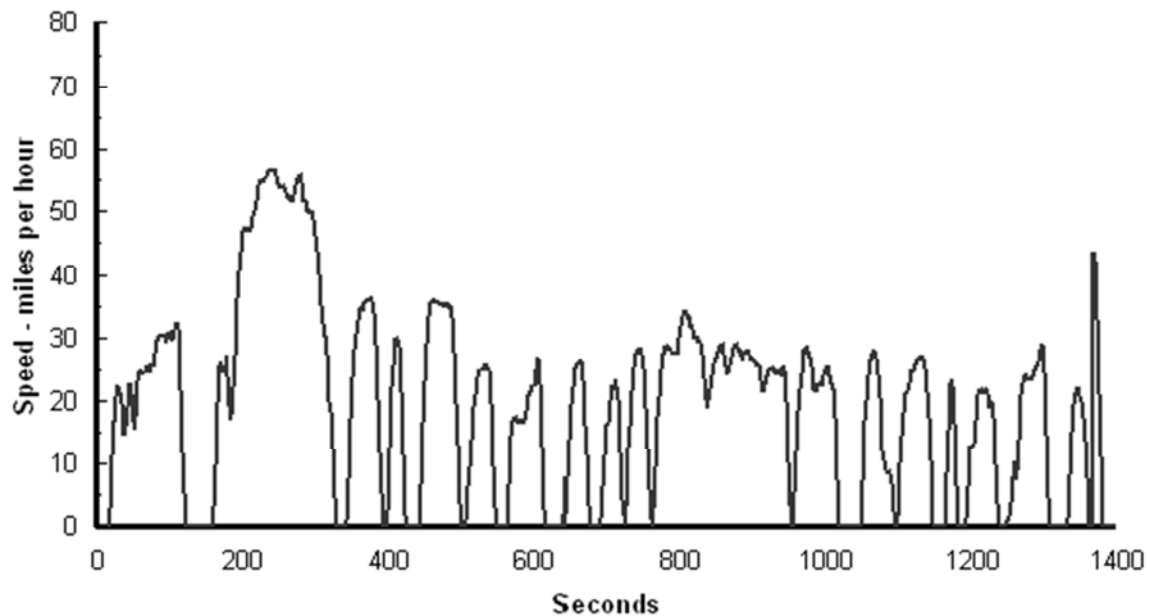
**Figure 4.5. Air Conditioning (SC03) Driving Cycle**



**Source:**

U.S. Department of Energy and Environmental Protection Agency, Fuel Economy Web site,  
[www.fueleconomy.gov](http://www.fueleconomy.gov).

**Figure 4.6. Cold Temperature (Cold FTP) Driving Cycle**



**Source:**

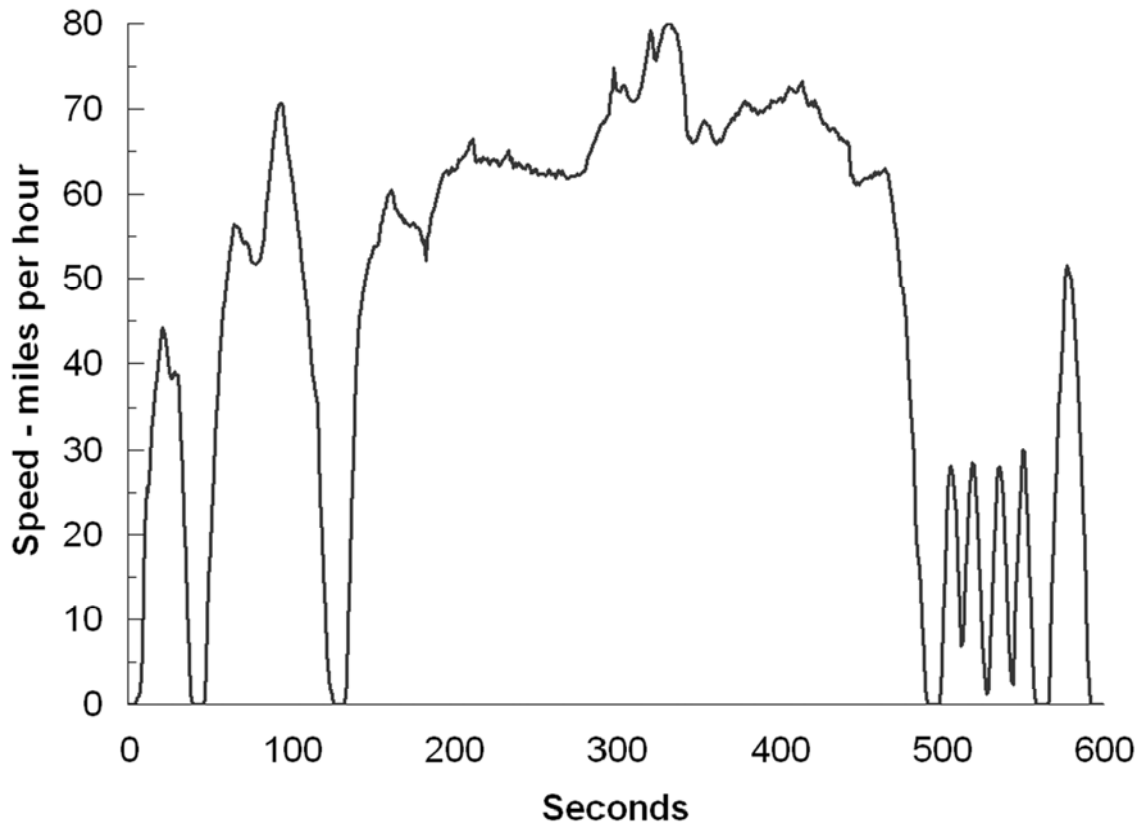
U.S. Department of Energy and Environmental Protection Agency, Fuel Economy Web site,  
[www.fueleconomy.gov](http://www.fueleconomy.gov).





*Beginning with the 2008 model year, this cycle influences the new vehicle fuel economy ratings. The US06 driving cycle was originally developed as a supplement to the Federal Test Procedure. It is a short-duration cycle (600 seconds) which represents hard-acceleration driving.*

**Figure 4.7. High-Speed (US06) Driving Cycle**



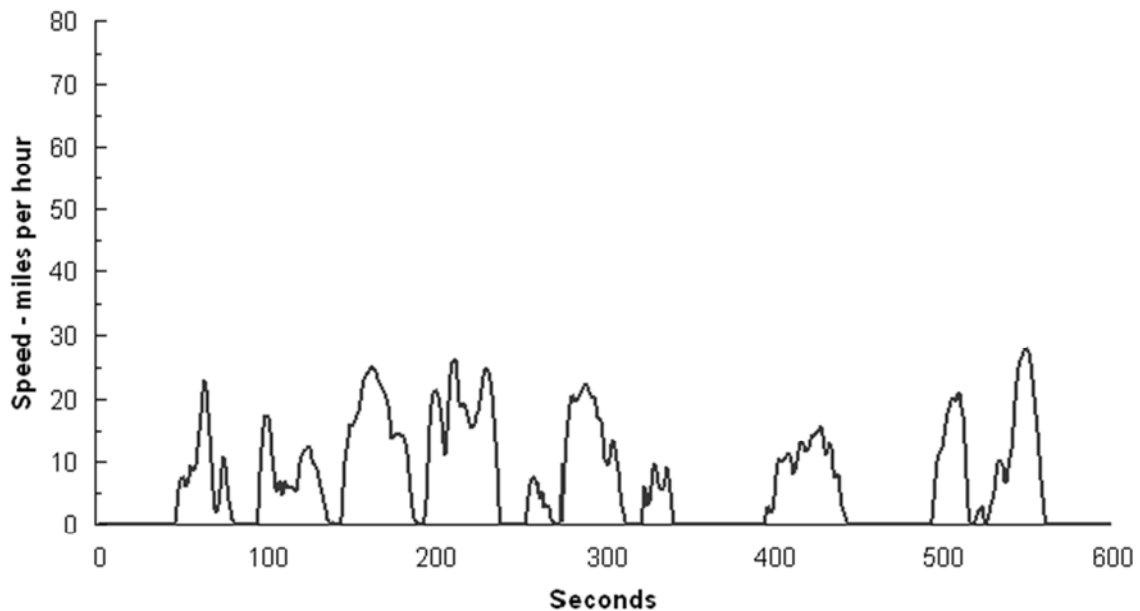
**Source:**

U.S. Department of Energy and Environmental Protection Agency, Fuel Economy Web site, [www.fueleconomy.gov](http://www.fueleconomy.gov).

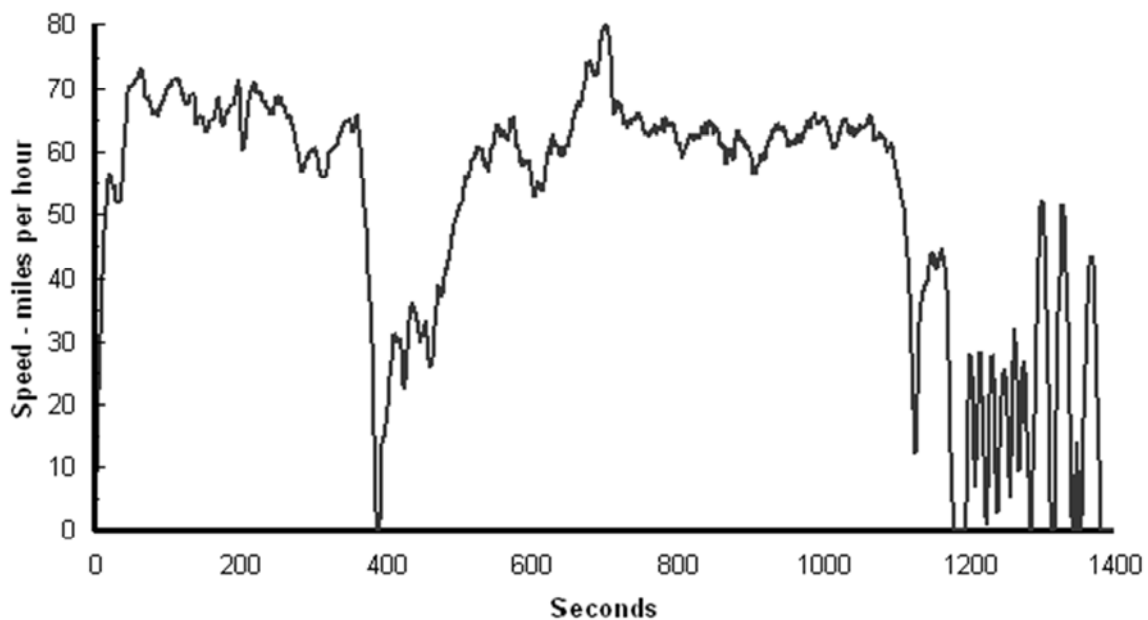


*The Environmental Protection Agency also uses other driving cycles to test new vehicles (although these do not affect the fuel economy ratings). The New York Test Cycle was developed in the 1970's in order to simulate driving in downtown congested areas. The Representative Number Five Test Cycle was developed in the 1990's to better represent actual on-road driving by combining modern city and freeway driving.*

**Figure 4.8. New York City Driving Cycle**



**Figure 4.9. Representative Number Five Driving Cycle**



**Source:**

Data obtained from Michael Wang, Argonne National Laboratory, Argonne, IL, 1997.



*Researchers at Argonne National Laboratory have estimated the fuel economy of a midsize car using driving cycles from different countries. These results illustrate the difference in fuel economy which can be obtained from the same vehicle using different test cycles.*

**Table 4.29**  
**Projected Fuel Economies from U.S., European, and Japanese Driving Cycles**

| Driving Cycle                             | Projected fuel economy<br>for a 1995 composite<br>midsize vehicle <sup>a</sup> |
|---|--|
| Japanese 10/15 mode test cycle            | 17.5 mpg   |
| New European Driving Cycle (NEDC)         | 22.0 mpg   |
| U.S. EPA city cycle (LA4)                 | 19.8 mpg   |
| U.S. EPA highway cycle                    | 32.1 mpg   |
| U.S. Corporate Average Fuel Economy cycle | 23.9 mpg   |

**Source:**

Santini, D., A. Vyas, J. Anderson, and F. An, *Estimating Trade-Offs along the Path to the PNGV 3X Goal*, presented at the Transportation Research Board 80<sup>th</sup> Annual Meeting, Washington, DC, January 2001.

**Note:** China and India both use the European Driving Cycle, though India uses a modified version called the Modified Indian Driving Cycle which accounts for lower maximum speeds that better represent driving conditions in India.

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<sup>a</sup> The 1995 composite midsize vehicle is an average of a Chevrolet Lumina, Chrysler Concord, and Ford Taurus. The fuel economies were projected using the National Renewable Energy Laboratory's Advanced Vehicle Simulator (ADVISOR) model.



*When comparing data between countries, one must realize that different countries have different testing cycles to determine fuel economy and emissions. This table compares various statistics on the European, Japanese, and U.S. testing cycles [for fuel economy measurements, the United States uses the formula,  $1/\text{fuel economy} = (0.55/\text{city fuel economy}) + (0.45/\text{highway fuel economy})$ ]. Most vehicles will achieve higher fuel economy on the U.S. test cycle than on the European or Japanese cycles.*

**Table 4.30**  
**Comparison of U.S., European, and Japanese Driving Cycles**

|  | Time<br>(seconds) | Percent of<br>time<br>stopped<br>or<br>decelerating | Distance<br>(miles) | Average<br>speed<br>(mph) | Maximum<br>speed<br>(mph) | Maximum<br>acceleration<br>(mph/s) |
|--|-------------------|---|---------------------|---------------------------|---------------------------|------------------------------------|
| Japanese 10/15 mode<br>test cycle            | 631               | 52.3  | 2.6                 | 14.8                      | 43.5                      | 1.8                                |
| New European Driving<br>Cycle (NEDC)         | 1,181             | 24.9  | 6.84                | 20.9                      | 74.6                      | 2.4                                |
| U.S. EPA city cycle<br>(LA4) <sup>a</sup>    | 1,372             | 43.2  | 7.5                 | 19.5                      | 56.7                      | 3.3                                |
| U.S. EPA highway cycle                       | 765               | 9.3   | 17.8                | 48.2                      | 59.9                      | 3.3                                |
| U.S. Corporate Average<br>Fuel Economy cycle | 2,137             | 27.9  | 10.3                | 29.9                      | 59.9                      | 3.3                                |

**Source:**

Santini, D., A. Vyas, J. Anderson, and F. An, *Estimating Trade-Offs along the Path to the PNGV 3X Goal*, presented at the Transportation Research Board 80<sup>th</sup> Annual Meeting, Washington, DC, January 2001.

**Note:** China and India both use the European Driving Cycle, though India uses a modified version called The Modified Indian Driving Cycle which accounts for lower maximum speeds that better represent driving conditions in India.

<sup>a</sup> The actual Federal Procedure (FTP), which is also the test for emissions certification, repeats the first 505 seconds of the Federal Urban Driving Simulation cycle, hot started, after a 10 minute hot soak. Starting with Model Year 2001, the emissions test-but not the fuel economy test-incorporates a supplemental cycle that simulates aggressive urban driving, coupled with an added air conditioning load.



*Demand response vehicles (also called paratransit or dial-a-ride) are widely used by transit agencies. The vehicles do not operate over a fixed route or on a fixed schedule. The vehicle may be dispatched to pick up several passengers at different pick-up points before taking them to their respective destinations and may even be interrupted en route to these destinations to pick up other passengers. Demand response service is provided primarily by vans. In 2007, the data changed substantially due to improved estimation methodologies. Unfortunately, those data are no longer comparable to the rest of the historical series.*

**Table 4.31**  
**Summary Statistics on Demand Response Vehicles, 1994–2009<sup>a</sup>**

| Year              | Number of agencies | Number of active vehicles | Vehicle-miles (millions) | Average miles per vehicle | Passenger-miles (millions) | Energy use (trillion Btu) |
|-------------------|--------------------|---------------------------|--------------------------|---------------------------|----------------------------|---------------------------|
| 1994              | 5,214              | 28,729                    | 463.7                    | 16.14                     | 577                        | 9.5                       |
| 1995              | 5,214              | 29,352                    | 506.5                    | 17.26                     | 607                        | 9.2                       |
| 1996              | 5,214              | 30,804                    | 548.3                    | 17.80                     | 656                        | 9.9                       |
| 1997              | 5,214              | 32,509                    | 585.3                    | 18.00                     | 754                        | 9.8                       |
| 1998              | 5,214              | 29,646                    | 670.9                    | 22.63                     | 735                        | 10.4                      |
| 1999              | 5,252              | 31,884                    | 718.4                    | 22.53                     | 813                        | 10.6                      |
| 2000              | 5,252              | 33,080                    | 758.9                    | 22.94                     | 839                        | 10.8                      |
| 2001              | 5,251              | 34,661                    | 789.3                    | 22.77                     | 855                        | 11.3                      |
| 2002              | 5,251              | 34,699                    | 802.6                    | 23.13                     | 853                        | 11.6                      |
| 2003              | 5,346              | 35,954                    | 864.0                    | 24.03                     | 930                        | 12.9                      |
| 2004              | 5,960              | 37,078                    | 889.5                    | 23.99                     | 962                        | 13.3                      |
| 2005              | 5,960              | 41,958                    | 978.3                    | 23.32                     | 1,058                      | 14.8                      |
| 2006              | 5,960              | 43,509                    | 1,013.0                  | 23.28                     | 1,078                      | 15.5                      |
| 2007 <sup>a</sup> | 7,300              | 64,865                    | 1,471.4                  | 22.68                     | 1,502                      | 24.7                      |
| 2008              | 7,200              | 65,799                    | 1,495.2                  | 22.72                     | 1,412                      | 24.7                      |
| 2009              | 6,700              | 68,947                    | 1,529.2                  | 22.18                     | 1,477                      | 23.1                      |

**Source:**

American Public Transportation Association, *2011 Public Transportation Fact Book*, Washington, DC, April 2011.  
(Additional resources: [www.apta.com](http://www.apta.com))

**Note:** See Glossary for detailed definitions of demand response.

<sup>a</sup> Data are not continuous between 2006 and 2007 due to changes in estimation methodology. See source document for details.





## Chapter 5

### Heavy Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

| Source                  |   |         |
|-------------------------|---|---------|
| Table 5.1               | Heavy single-unit trucks, 2009                |         |
|                         | <i>Registration (thousands)</i>               | 8,356   |
|                         | <i>Vehicle miles (millions)</i>               | 120,163 |
|                         | <i>Fuel economy (miles per gallon)</i>        | 7.4     |
| Table 5.2               | Combination trucks, 2009                      |         |
|                         | <i>Registration (thousands)</i>               | 2,617   |
|                         | <i>Vehicle miles (millions)</i>               | 167,842 |
|                         | <i>Fuel economy (miles per gallon)</i>        | 6.0     |
| Tables 5.14<br>and 5.15 | Freight Shipments, 2007 Commodity Flow Survey |         |
|                         | <i>Value (billion dollars)</i>                | 11,685  |
|                         | <i>Tons (millions)</i>                        | 12,543  |
|                         | <i>Ton-miles (billions)</i>                   | 3,348   |
| Table 5.16              | Transit buses in operation, 2009              | 65,363  |



*Heavy single-unit trucks include all single-unit trucks which have more than two axles or more than four tires. Most of these trucks would be used for business or for individuals with heavy hauling or towing needs. The data series was recently changed by the FHWA back to 2007.*

**Table 5.1**  
**Summary Statistics for Heavy Single-Unit Trucks, 1970–2009**

| Year                                    | Registrations<br>(thousands) | Vehicle travel<br>(million miles) | Fuel use<br>(million gallons) | Fuel economy<br>(miles per gallon) |
|---|------------------------------|-----------------------------------|-------------------------------|------------------------------------|
| 1970                                    | 3,681                        | 27,081                            | 3,968                         | 6.8                                |
| 1975                                    | 4,232                        | 34,606                            | 5,420                         | 6.4                                |
| 1976                                    | 4,350                        | 36,390                            | 5,706                         | 6.4                                |
| 1977                                    | 4,450                        | 39,339                            | 6,268                         | 6.3                                |
| 1978                                    | 4,518                        | 42,747                            | 6,955                         | 6.1                                |
| 1979                                    | 4,505                        | 42,012                            | 7,050                         | 6.0                                |
| 1980                                    | 4,374                        | 39,813                            | 6,923                         | 5.8                                |
| 1981                                    | 4,455                        | 39,568                            | 6,867                         | 5.8                                |
| 1982                                    | 4,325                        | 40,658                            | 6,803                         | 6.0                                |
| 1983                                    | 4,204                        | 42,546                            | 6,965                         | 6.1                                |
| 1984                                    | 4,061                        | 44,419                            | 7,240                         | 6.1                                |
| 1985                                    | 4,593                        | 45,441                            | 7,399                         | 6.1                                |
| 1986                                    | 4,313                        | 45,637                            | 7,386                         | 6.2                                |
| 1987                                    | 4,188                        | 48,022                            | 7,523                         | 6.4                                |
| 1988                                    | 4,470                        | 49,434                            | 7,701                         | 6.4                                |
| 1989                                    | 4,519                        | 50,870                            | 7,779                         | 6.5                                |
| 1990                                    | 4,487                        | 51,901                            | 8,357                         | 6.2                                |
| 1991                                    | 4,481                        | 52,898                            | 8,172                         | 6.5                                |
| 1992                                    | 4,370                        | 53,874                            | 8,237                         | 6.5                                |
| 1993                                    | 4,408                        | 56,772                            | 8,488                         | 6.7                                |
| 1994                                    | 4,906                        | 61,284                            | 9,032                         | 6.8                                |
| 1995                                    | 5,024                        | 62,705                            | 9,216                         | 6.8                                |
| 1996                                    | 5,266                        | 64,072                            | 9,409                         | 6.8                                |
| 1997                                    | 5,293                        | 66,893                            | 9,576                         | 7.0                                |
| 1998                                    | 5,414                        | 67,894                            | 9,741                         | 7.0                                |
| 1999                                    | 5,763                        | 70,304                            | 9,372                         | 7.5                                |
| 2000                                    | 5,926                        | 70,500                            | 9,563                         | 7.4                                |
| 2001                                    | 5,704                        | 72,448                            | 9,667                         | 7.5                                |
| 2002                                    | 5,651                        | 75,866                            | 10,321                        | 7.4                                |
| 2003                                    | 5,849                        | 77,757                            | 8,881                         | 8.8                                |
| 2004                                    | 6,161                        | 78,441                            | 8,959                         | 8.8                                |
| 2005                                    | 6,395                        | 78,496                            | 9,501                         | 8.3                                |
| 2006                                    | 6,649                        | 80,344                            | 9,852                         | 8.2                                |
| 2007                                    | 8,117                        | 119,979                           | 16,314                        | 7.3                                |
| 2008                                    | 8,228                        | 126,855                           | 17,144                        | 7.4                                |
| 2009                                    | 8,356                        | 120,163                           | 16,342                        | 7.4                                |
| <i>Average annual percentage change</i> |                              |                                   |                               |                                    |
| 1970–2009                               | 2.1%                         | 3.9%                              | 3.7%                          | 0.2%                               |
| 2000–2009                               | 2.6%                         | 2.0%                              | 2.1%                          | 0.0%                               |

**Source:**

U. S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2009*, Washington, DC, 2011, Table VM1 and annual. (Additional resources: [www.fhwa.dot.gov](http://www.fhwa.dot.gov))

**Note:** Due to FHWA methodology changes, data from 2007-on are not comparable with previous data.





*Combination trucks include all trucks designed to be used in combination with one or more trailers. The average vehicle travel of these trucks (on a per truck basis) far surpasses the travel of other trucks due to long-haul freight movement. The data series was recently changed by the FHWA back to 2007.*

**Table 5.2**  
**Summary Statistics for Combination Trucks, 1970–2009**

| Year                                    | Registrations<br>(thousands) | Vehicle travel <sup>a</sup><br>(million miles) | Fuel use<br>(million gallons) | Fuel economy<br>(miles per gallon) |
|---|------------------------------|--|-------------------------------|------------------------------------|
| 1970                                    | 905                          | 35,134   | 7,348                         | 4.8                                |
| 1975                                    | 1,131                        | 46,724   | 9,177                         | 5.1                                |
| 1980                                    | 1,417                        | 68,678   | 13,037                        | 5.3                                |
| 1981                                    | 1,261                        | 69,134   | 13,509                        | 5.1                                |
| 1982                                    | 1,265                        | 70,765   | 13,583                        | 5.2                                |
| 1983                                    | 1,304                        | 73,586   | 13,796                        | 5.3                                |
| 1984                                    | 1,340                        | 77,377   | 14,188                        | 5.5                                |
| 1985                                    | 1,403                        | 78,063   | 14,005                        | 5.6                                |
| 1986                                    | 1,408                        | 81,038   | 14,475                        | 5.6                                |
| 1987                                    | 1,530                        | 85,495   | 14,990                        | 5.7                                |
| 1988                                    | 1,667                        | 88,551   | 15,224                        | 5.8                                |
| 1989                                    | 1,707                        | 91,879   | 15,733                        | 5.8                                |
| 1990                                    | 1,709                        | 94,341   | 16,133                        | 5.8                                |
| 1991                                    | 1,691                        | 96,645   | 16,809                        | 5.7                                |
| 1992                                    | 1,675                        | 99,510   | 17,216                        | 5.8                                |
| 1993                                    | 1,680                        | 103,116  | 17,748                        | 5.8                                |
| 1994                                    | 1,681                        | 108,932  | 18,653                        | 5.8                                |
| 1995                                    | 1,696                        | 115,451  | 19,777                        | 5.8                                |
| 1996                                    | 1,747                        | 118,899  | 20,192                        | 5.9                                |
| 1997                                    | 1,790                        | 124,584  | 20,302                        | 6.1                                |
| 1998                                    | 1,831                        | 128,159  | 21,100                        | 6.1                                |
| 1999                                    | 2,029                        | 132,384  | 24,537                        | 5.4                                |
| 2000                                    | 2,097                        | 135,020  | 25,666                        | 5.3                                |
| 2001                                    | 2,154                        | 136,584  | 25,512                        | 5.4                                |
| 2002                                    | 2,277                        | 138,737  | 26,480                        | 5.2                                |
| 2003                                    | 1,908                        | 140,160  | 23,815                        | 5.9                                |
| 2004                                    | 2,010                        | 142,370  | 24,191                        | 5.9                                |
| 2005                                    | 2,087                        | 144,028  | 27,689                        | 5.2                                |
| 2006                                    | 2,170                        | 142,169  | 28,107                        | 5.1                                |
| 2007                                    | 2,635                        | 184,199  | 30,904                        | 6.0                                |
| 2008                                    | 2,585                        | 183,826  | 30,561                        | 6.0                                |
| 2009                                    | 2,617                        | 167,842  | 28,130                        | 6.0                                |
| <i>Average annual percentage change</i> |                              |  |                               |                                    |
| 1970–2009                               | 2.8%                         | 4.1%   | 3.5%                          | 0.6%                               |
| 2000–2009                               | 0.9%                         | 0.4%   | -0.1%                         | -0.6%                              |

**Source:**

U. S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2009*, Washington, DC, 2011, Table VM1 and annual. (Additional resources: [www.fhwa.dot.gov](http://www.fhwa.dot.gov))

**Note:** Due to FHWA methodology changes, data from 2007-on are not comparable with previous data. A methodology change also occurred in 1993.

<sup>a</sup> The Federal Highway Administration changed the combination truck travel methodology in 1993.



*Truck sales rose in 2010 for the first time since the sales peak in 2004. Trucks under 10,000 lbs. continue to dominate truck sales.*

**Table 5.3**  
**New Retail Truck Sales by Gross Vehicle Weight, 1970–2010<sup>a</sup>**  
**(thousands)**

| Calendar year   | Class 1<br>6,000 lbs.<br>or less | Class 2<br>6,001–<br>10,000 lbs. | Class 3<br>10,001–<br>14,000 lbs. | Class 4<br>14,001–<br>16,000 lbs. | Class 5<br>16,001–<br>19,500 lbs. | Class 6<br>19,501–<br>26,000 lbs. | Class 7<br>26,001–<br>33,000 lbs. | Class 8<br>33,001 lbs.<br>and over | Total |
|---|----------------------------------|----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|------------------------------------|-------|
| <b>Domestic sales (import data are not available)</b> |                                  |                                  |                                   |                                   |                                   |                                   |                                   |                                    |       |
| 1970 <sup>b</sup>                                     | 1,049                            | 408                              | 6                                 | 12                                | 58                                | 133                               | 36                                | 89                                 | 1,791 |
| 1975  | 1,101                            | 952                              | 23                                | 1                                 | 9                                 | 159                               | 23                                | 83                                 | 2,351 |
| 1976  | 1,318                            | 1,401                            | 43                                | <sup>c</sup>                      | 9                                 | 153                               | 22                                | 97                                 | 3,043 |
| 1977  | 1,306                            | 1,803                            | 36                                | 3                                 | 5                                 | 163                               | 28                                | 141                                | 3,485 |
| 1978  | 1,334                            | 2,140                            | 73                                | 6                                 | 3                                 | 156                               | 41                                | 162                                | 3,915 |
| 1979  | 1,271                            | 1,574                            | 15                                | 3                                 | 3                                 | 146                               | 50                                | 174                                | 3,236 |
| 1980  | 985                              | 975                              | 4                                 | <sup>c</sup>                      | 2                                 | 90                                | 58                                | 117                                | 2,231 |
| 1981  | 896                              | 850                              | 1                                 | <sup>c</sup>                      | 2                                 | 72                                | 51                                | 100                                | 1,972 |
| 1982  | 1,102                            | 961                              | 1                                 | <sup>c</sup>                      | 1                                 | 44                                | 62                                | 76                                 | 2,248 |
| 1983  | 1,314                            | 1,207                            | <sup>c</sup>                      | <sup>c</sup>                      | 1                                 | 47                                | 59                                | 82                                 | 2,710 |
| 1984  | 2,031                            | 1,224                            | 6                                 | <sup>c</sup>                      | 5                                 | 55                                | 78                                | 138                                | 3,538 |
| 1985  | 2,408                            | 1,280                            | 11                                | <sup>c</sup>                      | 5                                 | 48                                | 97                                | 134                                | 3,983 |
| <b>Domestic and import sales</b>                      |                                  |                                  |                                   |                                   |                                   |                                   |                                   |                                    |       |
| 1986  | 3,380                            | 1,214                            | 12                                | <sup>c</sup>                      | 6                                 | 45                                | 101                               | 113                                | 4,870 |
| 1987  | 3,435                            | 1,175                            | 14                                | 2                                 | 8                                 | 44                                | 103                               | 131                                | 4,912 |
| 1988  | 3,467                            | 1,333                            | 14                                | 21                                | 8                                 | 54                                | 103                               | 148                                | 5,149 |
| 1989  | 3,313                            | 1,297                            | 19                                | 27                                | 7                                 | 39                                | 93                                | 145                                | 4,942 |
| 1990  | 3,451                            | 1,097                            | 21                                | 27                                | 5                                 | 38                                | 85                                | 121                                | 4,846 |
| 1991  | 3,246                            | 876                              | 21                                | 24                                | 3                                 | 22                                | 73                                | 99                                 | 4,365 |
| 1992  | 3,608                            | 1,021                            | 26                                | 26                                | 4                                 | 28                                | 73                                | 119                                | 4,903 |
| 1993  | 4,119                            | 1,232                            | 27                                | 33                                | 4                                 | 27                                | 81                                | 158                                | 5,681 |
| 1994  | 4,527                            | 1,506                            | 35                                | 44                                | 4                                 | 20                                | 98                                | 186                                | 6,421 |
| 1995  | 4,422                            | 1,631                            | 40                                | 53                                | 4                                 | 23                                | 107                               | 201                                | 6,481 |
| 1996  | 4,829                            | 1,690                            | 52                                | 59                                | 7                                 | 19                                | 104                               | 170                                | 6,930 |
| 1997  | 5,085                            | 1,712                            | 53                                | 57                                | 9                                 | 18                                | 114                               | 179                                | 7,226 |
| 1998  | 5,263                            | 2,036                            | 102                               | 43                                | 25                                | 32                                | 115                               | 209                                | 7,826 |
| 1999  | 5,707                            | 2,366                            | 122                               | 49                                | 30                                | 48                                | 130                               | 262                                | 8,716 |
| 2000  | 5,965                            | 2,421                            | 117                               | 47                                | 29                                | 51                                | 123                               | 212                                | 8,965 |
| 2001  | 6,073                            | 2,525                            | 102                               | 52                                | 24                                | 42                                | 92                                | 140                                | 9,050 |
| 2002  | 6,068                            | 2,565                            | 80                                | 38                                | 24                                | 45                                | 69                                | 146                                | 9,035 |
| 2003  | 6,267                            | 2,671                            | 91                                | 40                                | 29                                | 51                                | 67                                | 142                                | 9,357 |
| 2004  | 6,458                            | 2,796                            | 107                               | 47                                | 36                                | 70                                | 75                                | 203                                | 9,793 |
| 2005  | 6,586                            | 2,528                            | 167                               | 49                                | 46                                | 60                                | 89                                | 253                                | 9,777 |
| 2006  | 6,136                            | 2,438                            | 150                               | 50                                | 49                                | 70                                | 91                                | 284                                | 9,268 |
| 2007  | 5,682                            | 2,623                            | 166                               | 51                                | 45                                | 54                                | 70                                | 151                                | 8,842 |
| 2008  | 4,358                            | 1,888                            | 135                               | 36                                | 40                                | 39                                | 49                                | 133                                | 6,680 |
| 2009  | 3,528                            | 1,306                            | 112                               | 20                                | 24                                | 22                                | 39                                | 95                                 | 5,145 |
| 2010  | 4,245                            | 1,513                            | 161                               | 12                                | 31                                | 29                                | 38                                | 107                                | 6,137 |
| <i>Average annual percentage change</i>               |                                  |                                  |                                   |                                   |                                   |                                   |                                   |                                    |       |
| 1970–1985   | 5.7%                             | 7.9%                             | 4.1%                              | -                                 | -15.1%                            | -6.6%                             | 6.8%                              | 2.8%                               | 5.5%  |
| 1986–2010   | 1.0%                             | 0.9%                             | 11.4%                             | 8.5% <sup>d</sup>                 | 7.1%                              | -1.8%                             | -4.0%                             | -0.2%                              | 1.0%  |
| 2000–2010   | -3.3%                            | -4.6%                            | 3.2%                              | -12.8%                            | 0.7%                              | -5.5%                             | -11.1%                            | -6.6%                              | -3.7% |

**Source:**

Ward's Communication's, *Motor Vehicle Facts and Figures 2010*, Southfield, MI, 2010, p. 27, and annual; 2010: Ward's Communications, [www.wardsauto.com](http://www.wardsauto.com). (Additional resources: [www.wardsauto.com](http://www.wardsauto.com))

<sup>a</sup> Sales include domestic-sponsored imports.

<sup>b</sup> Data for 1970 is based on new truck registrations.

<sup>c</sup> Data are not available.

<sup>d</sup> 1987–2010.



*The Census Bureau has discontinued the Vehicle Inventory and Use Survey; it was not conducted in 2007. The 2002 data remain the latest available.*

## Vehicle Inventory and Use Survey

The Vehicle Inventory and Use Survey (VIUS), which was formerly the Truck Inventory and Use Survey (TIUS), provides data on the physical and operational characteristics of the Nation's truck population. It is based on a probability sample of private and commercial trucks registered (or licensed) in each state. In 1997, the survey was changed to the Vehicle Inventory and Use Survey due to future possibilities of including additional vehicle types. The 2002 VIUS, however, only includes trucks. Copies of the 2002 VIUS report or CD may be obtained by contacting the U.S. Bureau of the Census, Transportation Characteristics Surveys Branch (301) 457-2797. Internet site: **[www.census.gov/svsd/www/tiusview.html](http://www.census.gov/svsd/www/tiusview.html)**

Since 1987, the survey has included minivans, vans, station wagons on truck chassis, and sport utility vehicles in addition to the bigger trucks. The 1977 and 1982 surveys did not include those vehicle types. The estimated number of trucks that were within the scope of the 2002 VIUS and registered in the United States as of July 1, 2002 was 85.2 million. These trucks were estimated to have been driven a total of 1,115 billion miles during 2002, an increase of 6.8% from 1997. The average annual miles traveled per truck was estimated at 13,100 miles.

In the 2002 VIUS, there are several ways to classify a truck by weight. The survey respondent was asked the average weight of the vehicle or vehicle-trailer combination when carrying a typical payload; the empty weight (truck minus cargo) of the vehicle as it was usually operated; and the maximum gross weight at which the vehicle or vehicle-trailer combination was operated. The Census Bureau also collected information on the Gross Vehicle Weight Class of the vehicles (decoded from the vehicle identification number) and the registered weight of the vehicles from the State registration files. Some of these weights are only provided in categories, while others are exact weights. Since all these weights could be quite different for a single truck, the tabulations by weight can be quite confusing. In the tables presented here, the Gross Vehicle Weight Class was used.



**Table 5.4**  
**Truck Statistics by Gross Vehicle Weight Class, 2002**

| Manufacturer's gross vehicle weight class | Number of trucks | Percentage of trucks | Average annual miles per truck | Harmonic mean fuel economy | Percentage of fuel use |
|---|------------------|----------------------|--------------------------------|----------------------------|------------------------|
| 1) 6,000 lbs and less                     | 51,941,389       | 61.0%                | 11,882                         | 17.6                       | 42.7%                  |
| 2) 6,001 – 10,000 lbs                     | 28,041,234       | 32.9%                | 12,684                         | 14.3                       | 30.5%                  |
| Light truck subtotal                      | 79,982,623       | 93.9%                | 12,163                         | 16.2                       | 73.2%                  |
| 3) 10,001 – 14,000 lbs                    | 691,342          | 0.8%                 | 14,094                         | 10.5                       | 1.1%                   |
| 4) 14,001 – 16,000 lbs                    | 290,980          | 0.3%                 | 15,441                         | 8.5                        | 0.5%                   |
| 5) 16,001 – 19,500 lbs                    | 166,472          | 0.2%                 | 11,645                         | 7.9                        | 0.3%                   |
| 6) 19,501 – 26,000 lbs                    | 1,709,574        | 2.0%                 | 12,671                         | 7.0                        | 3.2%                   |
| Medium truck subtotal                     | 2,858,368        | 3.4%                 | 13,237                         | 8.0                        | 5.2%                   |
| 7) 26,001 – 33,000 lbs                    | 179,790          | 0.2%                 | 30,708                         | 6.4                        | 0.9%                   |
| 8) 33,001 lbs and up                      | 2,153,996        | 2.5%                 | 45,739                         | 5.7                        | 20.7%                  |
| Heavy truck subtotal                      | 2,333,786        | 2.7%                 | 44,581                         | 5.8                        | 21.6%                  |
| Total                                     | 85,174,776       | 100.0%               | 13,088                         | 13.5                       | 100.0%                 |

**Source:**

U.S. Department of Commerce, Bureau of the Census, *2002 Vehicle Inventory and Use Survey*, Microdata File on CD, 2005. (Additional resources: [www.census.gov/svsd/www.tiusview.html](http://www.census.gov/svsd/www.tiusview.html))

**Table 5.5**  
**Truck Harmonic Mean Fuel Economy by Size Class, 1992, 1997, and 2002**  
**(miles per gallon)**

| Manufacturer's gross vehicle weight class | 1992<br>TIUS | 1997<br>VIUS | 2002<br>VIUS |
|---|--------------|--------------|--------------|
| 1) 6,000 lbs and less                     | 17.2         | 17.1         | 17.6         |
| 2) 6,001–10,000 lbs                       | 13.0         | 13.6         | 14.3         |
| Light truck subtotal                      | 15.7         | 15.8         | 16.2         |
| 3) 10,000–14,000 lbs                      | 8.8          | 9.4          | 10.5         |
| 4) 14,001–16,000 lbs                      | 8.8          | 9.3          | 8.5          |
| 5) 16,001–19,500 lbs                      | 7.4          | 8.7          | 7.9          |
| 6) 19,501–26,000 lbs                      | 6.9          | 7.3          | 7.0          |
| Medium truck subtotal                     | 7.3          | 8.6          | 8.0          |
| 7) 26,001–33,000 lbs                      | 6.5          | 6.4          | 6.4          |
| 8) 33,001 lbs and over                    | 5.5          | 5.7          | 5.7          |
| Large truck subtotal                      | 5.6          | 6.1          | 5.8          |

**Sources:**

Estimates are based on data provided on the following public use files: U.S. Department of Commerce, Bureau of the Census, Census of Transportation, Washington, DC, *1992 Truck Inventory and Use Survey*, 1995; *1997 Vehicle Inventory and Use Survey*, 2000, and *2002 Vehicle Inventory and Use Survey*, 2005. (Additional resources: [www.census.gov/svsd/www.tiusview.html](http://www.census.gov/svsd/www.tiusview.html))

**Note:** Based on average fuel economy as reported by respondent.



*As expected, most light trucks travel within 50 miles of their home base and refuel at public stations. About sixty percent of heavy trucks travel over 50 miles from their home base and 36% of them refuel at central company-owned refueling stations.*

**Table 5.6**  
**Truck Statistics by Size, 2002**

|                          | Manufacturer's gross vehicle weight class |                                   |                         | Total         |
|--------------------------|---|-----------------------------------|-------------------------|---------------|
|                          | Light<br>(< 10,000 lbs)                   | Medium<br>(10,001–<br>26,000 lbs) | Heavy<br>(> 26,000 lbs) |               |
|                          | Range of operation                        |                                   |                         |               |
| Under 50 miles           | 69.2%                                     | 61.5%                             | 40.7%                   | 68.2%         |
| 51–100 miles             | 8.5%                                      | 11.7%                             | 13.5%                   | 8.7%          |
| 101–200 miles            | 2.4%                                      | 3.2%                              | 6.7%                    | 2.5%          |
| 201–500 miles            | 1.1%                                      | 1.8%                              | 7.6%                    | 1.3%          |
| 501 miles or more        | 1.4%                                      | 2.2%                              | 10.4%                   | 1.7%          |
| Off-road                 | 1.1%                                      | 3.5%                              | 3.2%                    | 1.2%          |
| Vehicle not in use       | 2.2%                                      | 4.4%                              | 3.2%                    | 2.3%          |
| Not reported             | 14.1%                                     | 11.7%                             | 14.7%                   | 14.1%         |
| <b>Total</b>             | <b>100.0%</b>                             | <b>100.0%</b>                     | <b>100.0%</b>           | <b>100.0%</b> |
|                          | Primary refueling facility                |                                   |                         |               |
| Gas station              | 96.9%                                     | 62.4%                             | 28.4%                   | 93.9%         |
| Truck stop               | 0.7%                                      | 7.7%                              | 31.9%                   | 1.8%          |
| Own facility             | 2.0%                                      | 27.3%                             | 36.2%                   | 3.7%          |
| Other nonpublic facility | 0.3%                                      | 2.6%                              | 3.5%                    | 0.5%          |
| Other                    | 0.0%                                      | 0.0%                              | 0.0%                    | 0.0%          |
| <b>All</b>               | <b>100.0%</b>                             | <b>100.0%</b>                     | <b>100.0%</b>           | <b>100.0%</b> |

**Source:**

U.S. Department of Commerce, Bureau of the Census, *2002 Vehicle Inventory and Use Survey*, Microdata. File on CD, 2005. (Additional resources: [www.census.gov/svsd/www/tiusview.html](http://www.census.gov/svsd/www/tiusview.html))



*More medium truck owners listed construction as the truck's major use than any other major use category. Construction was the second highest major use for light trucks and heavy trucks.*

**Table 5.7**  
**Percentage of Trucks by Size Ranked by Major Use, 2002**

| Rank | Light<br>(< 10,000 lbs<br>average weight) | Medium<br>(10,001 – 26,000 lbs<br>average weight) | Heavy<br>(> 26,000 lbs average<br>weight) |
|------|---|---|---|
| 1    | <b>Personal</b><br>81.5%                  | <b>Construction</b><br>18.4%                      | <b>For hire</b><br>30.1%                  |
| 2    | <b>Construction</b><br>4.6%               | <b>Agriculture</b><br>16.2%                       | <b>Construction</b><br>15.9%              |
| 3    | <b>Other services<sup>a</sup></b><br>2.5% | <b>For hire</b><br>9.6%                           | <b>Agriculture</b><br>12.2%               |
| 4    | <b>Not in use</b><br>2.2%                 | <b>Retail</b><br>7.1%                             | <b>Retail</b><br>5.4%                     |
| 5    | <b>Agriculture</b><br>1.9%                | <b>Not in use</b><br>6.4%                         | <b>Not in use</b><br>5.1%                 |
| 6    | <b>Retail</b><br>1.5%                     | <b>Leasing</b><br>6.2%                            | <b>Waste management</b><br>5.0%           |
| 7    | <b>Unknown</b><br>1.3%                    | <b>Wholesale</b><br>5.5%                          | <b>Manufacturing</b><br>4.9%              |
| 8    | <b>Leasing</b><br>0.7%                    | <b>Waste management</b><br>5.4%                   | <b>Wholesale</b><br>4.8%                  |
| 9    | <b>Manufacturing</b><br>0.7%              | <b>Utilities</b><br>5.0%                          | <b>Leasing</b><br>4.6%                    |
| 10   | <b>Utilities</b><br>0.6%                  | <b>Personal</b><br>4.8%                           | <b>Unknown</b><br>3.2%                    |
| 11   | <b>Waste management</b><br>0.6%           | <b>Unknown</b><br>4.4%                            | <b>Personal</b><br>2.5%                   |
| 12   | <b>Wholesale</b><br>0.6%                  | <b>Manufacturing</b><br>3.3%                      | <b>Mining</b><br>2.4%                     |
| 13   | <b>Information services</b><br>0.4%       | <b>Other services<sup>a</sup></b><br>3.2%         | <b>Other services<sup>a</sup></b><br>1.3% |
| 14   | <b>For hire</b><br>0.4%                   | <b>Food services</b><br>1.6%                      | <b>Utilities</b><br>1.1%                  |
| 15   | <b>Food services</b><br>0.3%              | <b>Information services</b><br>1.3%               | <b>Food services</b><br>1.1%              |
| 16   | <b>Arts</b><br>0.2%                       | <b>Mining</b><br>1.1%                             | <b>Arts</b><br>0.3%                       |
| 17   | <b>Mining</b><br>0.1%                     | <b>Arts</b><br>0.5%                               | <b>Information services</b><br>0.1%       |

**Source:**

U.S. Department of Commerce, Bureau of the Census, *2002 Vehicle Inventory and Use Survey*, Micro data File on CD, 2005. (Additional resources: [www.census.gov/svsd/www/tiusview.html](http://www.census.gov/svsd/www/tiusview.html))

<sup>a</sup> Business and personal services.



*Nearly half of trucks in fleets of 11-20 and 21-50 vehicles use company-owned facilities. Most trucks in smaller fleets use public gas stations for fueling.*

**Table 5.8**  
**Percentage of Trucks by Fleet Size and Primary Fueling Facility, 2002**

| Truck fleet size             | Primary refueling facility |             |              |                  | Total         |
|------------------------------|----------------------------|-------------|--------------|------------------|---------------|
|                              | Gas station                | Truck stop  | Own facility | Other's facility |               |
| 1-5                          | 73.8%                      | 6.1%        | 18.2%        | 1.9%             | 100.0%        |
| 6-10                         | 55.3%                      | 5.7%        | 35.5%        | 3.4%             | 100.0%        |
| 11-20                        | 41.1%                      | 5.1%        | 48.9%        | 4.9%             | 100.0%        |
| 21-50                        | 42.9%                      | 3.7%        | 49.8%        | 3.6%             | 100.0%        |
| 51 or more                   | 48.3%                      | 6.3%        | 44.4%        | 1.0%             | 100.0%        |
| Fleets of 6 or more vehicles | 47.6%                      | 5.2%        | 43.9%        | 3.4%             | 100.0%        |
| <b>No fleet</b>              | <b>96.4%</b>               | <b>1.6%</b> | <b>1.7%</b>  | <b>0.3%</b>      | <b>100.0%</b> |

**Source:**

U.S. Department of Commerce, Bureau of the Census, *2002 Vehicle Inventory and Use Survey*, Microdata File on CD, 2005. (Additional resources: [www.census.gov/svsd/www/tiusview.html](http://www.census.gov/svsd/www/tiusview.html))



*Most trucks are fueled at gas stations but for-hire or warehousing trucks are more often fueled at truck stops. Mining trucks and vehicle leasing or rental trucks fuel at the companies' own facility more than 30% of the time.*

**Table 5.9**  
**Share of Trucks by Major Use and Primary Fueling Facility, 2002**

| Major use                                       | Gas station   | Truck stop   | Own facility | Others facility | Other     | All            |
|---|---------------|--------------|--------------|-----------------|-----------|----------------|
| Personal  | 98.6%         | 0.6%         | 0.7%         | 0.1%            | 0.1%      | 100.0%         |
| Other services                                  | 96.0%         | 1.4%         | 1.6%         | 0.9%            | 0.1%      | 100.0%         |
| All   | 93.9%         | 1.8%         | 3.7%         | 0.5%            | 0.0%      | 100.0%         |
| Information services                            | 92.3%         | 0.4%         | 7.2%         | 0.1%            | 0.0%      | 100.0%         |
| Retail trade                                    | 86.6%         | 3.5%         | 8.6%         | 1.2%            | 0.0%      | 100.0%         |
| Construction                                    | 84.7%         | 3.3%         | 9.8%         | 2.2%            | 0.0%      | 100.0%         |
| Accommodation or food services                  | 82.4%         | 7.5%         | 8.8%         | 1.3%            | 0.0%      | 100.0%         |
| Manufacturing                                   | 81.5%         | 5.1%         | 11.9%        | 1.5%            | 0.0%      | 100.0%         |
| Arts, entertainment, recreation services        | 81.1%         | 4.3%         | 14.2%        | 0.3%            | 0.0%      | 100.0%         |
| Waste mgmt, landscaping, admin/support services | 78.2%         | 3.0%         | 17.1%        | 1.6%            | 0.0%      | 100.0%         |
| Wholesale trade                                 | 76.2%         | 6.6%         | 12.0%        | 5.1%            | 0.0%      | 100.0%         |
| Utilities                                       | 72.6%         | 1.8%         | 24.3%        | 1.3%            | 0.0%      | 100.0%         |
| Agriculture, forestry, fishing, hunting         | 62.7%         | 6.7%         | 29.4%        | 1.0%            | 0.1%      | 100.0%         |
| Vehicle leasing or rental                       | 60.2%         | 1.3%         | 31.8%        | 6.8%            | 0.0%      | 100.0%         |
| Mining  | 48.7%         | 8.5%         | 34.3%        | 8.5%            | 0.0%      | 100.0%         |
| For-hire or warehousing                         | 33.3%         | 38.7%        | 25.8%        | 2.3%            | 0.0%      | 100.0%         |
| <b>Overall</b>                                  | <b>93.90%</b> | <b>1.80%</b> | <b>3.70%</b> | <b>0.50%</b>    | <b>0%</b> | <b>100.00%</b> |

**Source:**

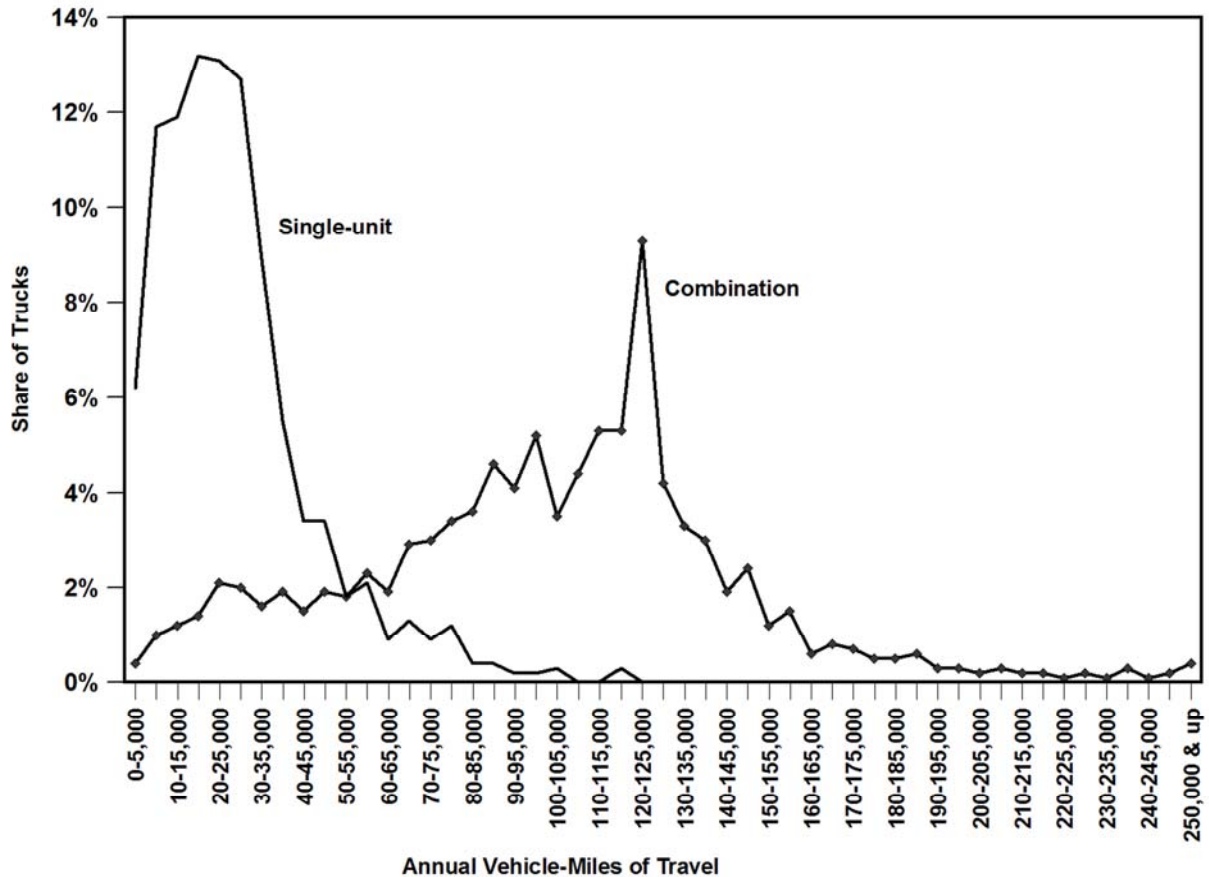
U.S. Department of Commerce, Bureau of the Census, *2002 Vehicle Inventory and Use Survey*, Microdata File on CD, 2005. (Additional resources: [www.census.gov/svsd/www/tiusview.html](http://www.census.gov/svsd/www/tiusview.html))





The figure below shows the distribution of annual travel the two types of Class 7 and 8 vehicles—combination units (separate tractor and trailer) and single units (tractor and trailer on a single chassis). This information is for vehicles two years old or less and comes from the 2002 VIUS. Combination trucks, dominated by box-type trailers, display the greatest amount of annual travel of all heavy vehicle types, as is evidenced both by the range of annual use which is up to 250,000 miles per year, and the peaking that occurs in the 100,000 to 140,000-mile segments. Most of the single-unit trucks in the survey travel 40,000 miles per year or less.

**Figure 5.1. Distribution of Trucks over 26,000 lbs. Less than Two Years Old by Vehicle-Miles Traveled**



**Source:**

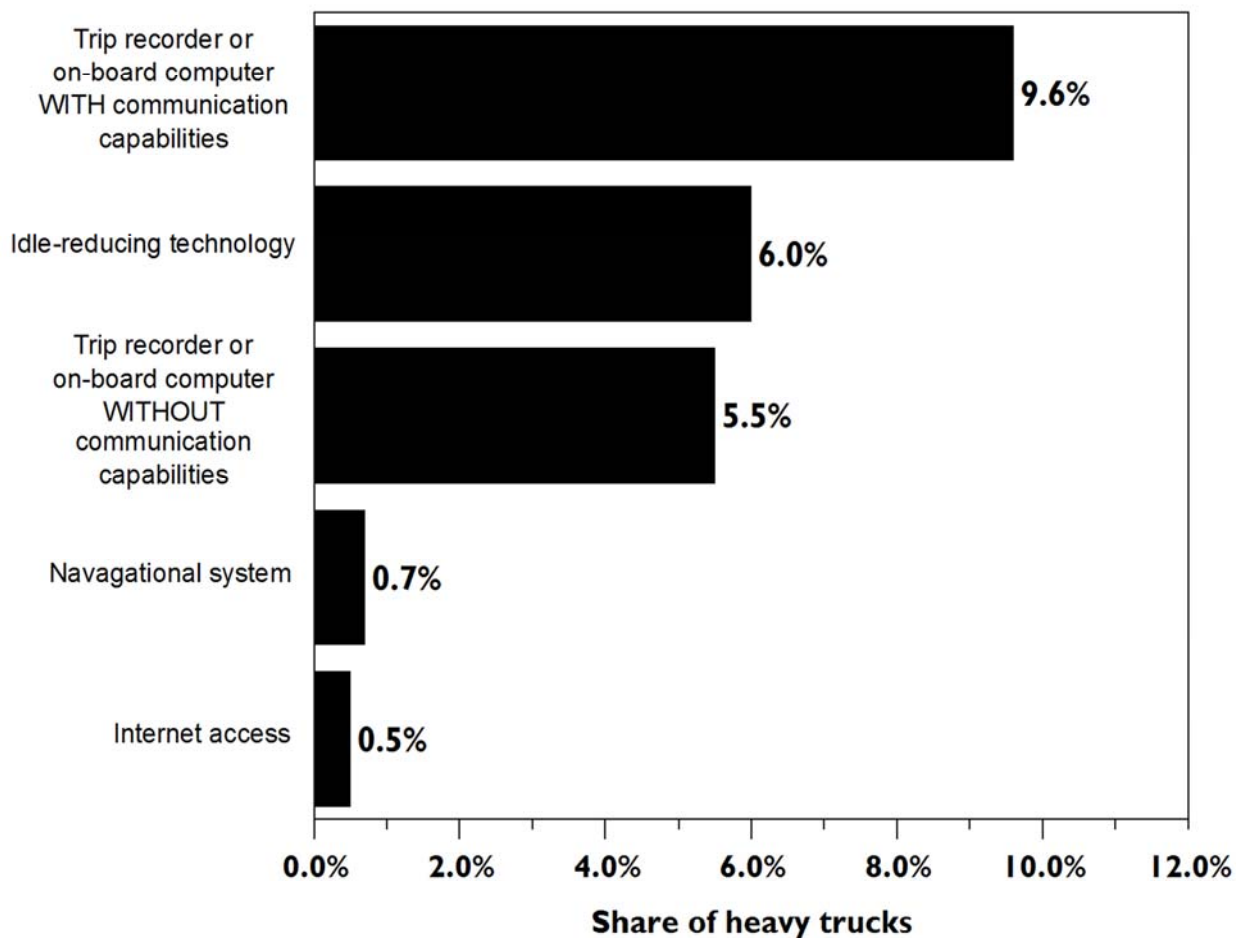
U.S. Department of Commerce, Bureau of the Census, 2002 Vehicle Inventory and Use Survey, Microdata File on CD, 2005. (Additional resources: [www.census.gov/svsd/www/tiusview.html](http://www.census.gov/svsd/www/tiusview.html))

**Note:** Heavy trucks (class 7 & 8) are greater than 26,000 pounds gross vehicle weight based on the manufacturer's rating.



*The latest Vehicle Inventory and Use Survey asked truck owners if the truck had certain features as permanent equipment on the truck. Some of the features asked about were onboard computers, idle-reduction devices, navigational systems, and Internet access. Of the 2.3 million heavy trucks (class 7 & 8) in the United States, nearly 10% were equipped with onboard computers that had communication capabilities and another 5% had onboard computers without communication capabilities. Six percent of heavy trucks were equipped with idle-reducing technology. Navigational systems and Internet access were available in less than one percent of heavy trucks.*

**Figure 5.2. Share of Heavy Trucks with Selected Electronic Features, 2002**



**Source:**

U.S. Department of Commerce, Bureau of the Census, *2002 Vehicle Inventory and User Survey*, Microdata File on CD, 2005.

**Note:** Heavy trucks (class 7 & 8) are greater than 26,000 pounds gross vehicle weight based on the manufacturer's rating.



## Fuel Economy Study for Class 8 Trucks

As part of a long-term study sponsored by the U.S. Department of Energy (DOE) Office of Vehicle Technologies (OVT), the Oak Ridge National Laboratory (ORNL) in conjunction with several industry partners has collected data and information related to heavy-truck operation in real-world highway environments. The primary objective of the project was to collect real-world performance and spatial data for long-haul operations of Class 8 tractor-trailers from a fleet engaged in normal freight operations. Six model year 2005 Class 8 trucks from the selected fleet, which operates within a large area of the country extending from the east coast to Mountain Time Zone and from Canada to the US-Mexican border, were instrumented and 60 channels of data were collected for over a year at a rate of 5 Hz (or 5 readings per second). Those channels included information such as instantaneous fuel rate, engine speed, gear ratio, vehicle speed, and other information read from the vehicle's databus; weather information (wind speed, precipitation, air temperature, etc.) gathered from an on-board weather station; spatial information (latitude, longitude, altitude) acquired from a GPS (Global Positioning System) device; and instantaneous tractor and trailer weight obtained from devices mounted on the six participating tractors and ten trailers. Three of the six instrumented tractors and five of the ten instrumented trailers were mounted with New Generation Single Wide-Based Tires and the others with regular dual tires. Over the duration of this phase of the project (just over a year) the six tractors traveled nearly 700,000 miles.

To find out more about this project, contact Oscar Franzese, [franzeseo@ornl.gov](mailto:franzeseo@ornl.gov), 865-946-1304. The final report on this project is available on-line at: [cta.ornl.gov/cta/Publications/Reports/ORNL\\_TM\\_2008-122.pdf](http://cta.ornl.gov/cta/Publications/Reports/ORNL_TM_2008-122.pdf).



*The type of terrain a truck is traveling on can cause significant differences in fuel efficiency. This study (see page 5-13 for project description) shows fuel economy on severe upslopes is less than half that on flat terrain. On severe downslopes, the fuel economy was three times higher than on flat terrain.*

**Table 5.10**  
**Effect of Terrain on Class 8 Truck Fuel Economy**

| Type of Terrain             | Share of Data Records | Average Fuel Efficiency (mpg) |                          |                                   |  |
|-----------------------------|-----------------------|-------------------------------|--------------------------|-----------------------------------|--|
|                             |                       | All Trucks                    | Tractors with Dual Tires | Tractors with Single (wide) Tires | Difference between Dual and Single Tires (percent) |
| Severe upslope (>4%)        | 0.7%                  | 2.90                          | 2.86                     | 2.94                              | 2.91%  |
| Mild upslope (1% to 4%)     | 13.2%                 | 4.35                          | 4.25                     | 4.44                              | 4.35%  |
| Flat terrain (1% to 1%)     | 72.4%                 | 7.33                          | 7.08                     | 7.58                              | 7.13%  |
| Mild downslope (-4% to -1%) | 12.6%                 | 15.11                         | 14.64                    | 15.57                             | 6.36%  |
| Severe downslope (<-4%)     | 1.1%                  | 23.5                          | 21.82                    | 25.3                              | 15.97%   |

**Source:**

Capps, Gary, Oscar Franzese, Bill Knee, M.B. Lascrain, and Pedro Otaduy. *Class-8 Heavy Truck Duty Cycle Project Final Report*, ORNL/TM-2008/122, Oak Ridge National Laboratory, Oak Ridge, TN, December 2008.



Table 5.10 presents a distribution of distance traveled, fuel consumed, and fuel economy by speed and by type of tires for the vehicles participating in the project (see page 5-13 for project description). The speed bins are divided into 5-mile intervals, going from 0+ mph (i.e., speed > 0.00 mph) to 85 mph, while the four main columns of Table 5.10 are organized by the type of tires that were mounted on the tractor and trailers. The first row of the table contains information about fuel consumed while the vehicle was idling (i.e., the vehicle was static with the engine on) with the following rows presenting information about the distance traveled, fuel consumed, and fuel economy for each one of the speed intervals. The next-to-the-last row shows the totals for both traveled distances and fuel consumed as well as the overall fuel economy for each tire-combination category. The latter are then used to compute the percentage difference in terms of fuel economy from dual tire tractors and trailers, which is the most common tire setup for large trucks at the present time.

**Table 5.11**  
**Fuel Economy for Class 8 Trucks as Function of Speed**  
**and Tractor-Trailer Tire Combination**

| Speed<br>(mph)   | Dual Tire Tractor –<br>Dual Tire Trailer |                        |                        | Dual Tire Tractor –<br>Single (Wide) Tire Trailer |                        |                        | Single (Wide) Tire Tractor –<br>Dual Tire Trailer |                        |                        | Single (Wide) Tire Tractor –<br>Single (Wide) Tire Trailer |                        |                        |
|--|--|------------------------|------------------------|---|------------------------|------------------------|---|------------------------|------------------------|--|------------------------|------------------------|
|  | Distance<br>Traveled<br>(miles)          | Fuel<br>Cons.<br>(gal) | Fuel<br>Econ.<br>(MPG) | Distance<br>Traveled<br>(miles)                   | Fuel<br>Cons.<br>(gal) | Fuel<br>Econ.<br>(MPG) | Distance<br>Traveled<br>(miles)                   | Fuel<br>Cons.<br>(gal) | Fuel<br>Econ.<br>(MPG) | Distance<br>Traveled<br>(miles)                            | Fuel<br>Cons.<br>(gal) | Fuel<br>Econ.<br>(MPG) |
| Idling   | N/A                                      | 1,858.5                | N/A                    | N/A   | 967.9                  | N/A                    | N/A   | 1,676.4                | N/A                    | N/A  | 706.0                  | N/A                    |
| 0+ to 5  | 281                                      | 101.8                  | 2.76                   | 148   | 50.4                   | 2.93                   | 368.0   | 124.2                  | 3.0                    | 156  | 52.8                   | 2.96                   |
| 5+ to 10   | 674                                      | 198.8                  | 3.39                   | 368   | 103.2                  | 3.56                   | 808.0   | 245.4                  | 3.3                    | 331  | 98.8                   | 3.35                   |
| 10+ to 15  | 723                                      | 192.0                  | 3.77                   | 396   | 98.3                   | 4.03                   | 848.0   | 216.5                  | 3.9                    | 343  | 87.0                   | 3.95                   |
| 15+ to 20  | 744                                      | 199.1                  | 3.73                   | 404   | 100.9                  | 4.00                   | 882.0   | 221.6                  | 4.0                    | 361  | 90.5                   | 3.98                   |
| 20+ to 25  | 938                                      | 228.4                  | 4.11                   | 489   | 113.6                  | 4.31                   | 1,111.0   | 244.2                  | 4.6                    | 462  | 101.1                  | 4.57                   |
| 25+ to 30  | 1,178                                    | 266.9                  | 4.41                   | 609   | 131.5                  | 4.63                   | 1,420.0   | 286.9                  | 5.0                    | 580  | 117.6                  | 4.93                   |
| 30+ to 35  | 1,481                                    | 336.8                  | 4.40                   | 753   | 154.2                  | 4.88                   | 1,774.0   | 341.1                  | 5.2                    | 708  | 141.1                  | 5.02                   |
| 35+ to 40  | 1,917                                    | 403.5                  | 4.75                   | 1,000   | 193.6                  | 5.17                   | 2,284.0   | 433.6                  | 5.3                    | 941  | 184.3                  | 5.10                   |
| 40+ to 45  | 2,955                                    | 584.1                  | 5.06                   | 1,543   | 285.9                  | 5.40                   | 3,380.0   | 603.6                  | 5.6                    | 1,350  | 254.4                  | 5.31                   |
| 45+ to 50  | 4,935                                    | 907.9                  | 5.43                   | 2,573   | 447.7                  | 5.75                   | 5,410.0   | 872.8                  | 6.2                    | 2,177  | 360.4                  | 6.04                   |
| 50+ to 55  | 9,397                                    | 1,629.8                | 5.77                   | 4,962   | 811.5                  | 6.11                   | 10,046.0  | 1,622.7                | 6.2                    | 3,877  | 625.5                  | 6.20                   |
| 55+ to 60  | 20,656                                   | 3,297.2                | 6.26                   | 11,707  | 1,721.9                | 6.80                   | 22,373.0  | 3,257.8                | 6.9                    | 8,710  | 1,246.9                | 6.99                   |
| 60+ to 65  | 38,964                                   | 5,879.6                | 6.63                   | 21,472  | 2,980.8                | 7.20                   | 34,517.0  | 4,840.0                | 7.1                    | 14,944   | 2,049.4                | 7.29                   |
| NOT ADJUSTED FOR TERRAIN: See note below.                                    |  |                        |                        |   |                        |                        |   |                        |                        |  |                        |                        |
| 65+ to 70  | 58,304                                   | 8,313.2                | 7.01                   | 27,931  | 3,652.2                | 7.65                   | 65,063.0  | 9,256.4                | 7.0                    | 27,144   | 3,880.1                | 7.00                   |
| 70+ to 75  | 56,378                                   | 7,483.2                | 7.53                   | 21,751  | 2,745.5                | 7.92                   | 66,882.0  | 8,435.6                | 7.9                    | 32,887   | 4,056.1                | 8.11                   |
| 75+ to 85  | 7,849                                    | 808.2                  | 9.71                   | 3,610   | 403.2                  | 8.95                   | 11,513.0  | 911.1                  | 12.6                   | 6,817  | 512.2                  | 13.31                  |
| Total <sup>a</sup>   | 207,374                                  | 30,831.0               | 6.73                   | 99,714  | 13,994.0               | 7.13                   | 228,680.0   | 31,913.0               | 7.2                    | 101,790  | 13,858.0               | 7.35                   |
| Percent<br>increase in<br>fuel<br>economy<br>from dual<br>tire<br>trac/trail | 0.00%                                    |                        |                        | 5.93%   |                        |                        | 6.53%   |                        |                        | 9.20%  |                        |                        |

**Source:**

Capps, Gary, Oscar Franzese, Bill Knee, M.B. Lascrain, and Pedro Otaduy. *Class-8 Heavy Truck Duty Cycle Project Final Report*, ORNL/TM-2008/122, Oak Ridge National Laboratory, Oak Ridge, TN, December 2008.

**Note:** These data were not adjusted to account for the effects of terrain. The increase in fuel economy for speeds above 70 mph is likely due to the vehicle achieving high speeds while traveling down slope. Therefore, this increase in fuel economy is not expected to be characteristic of all travel at these higher speeds.

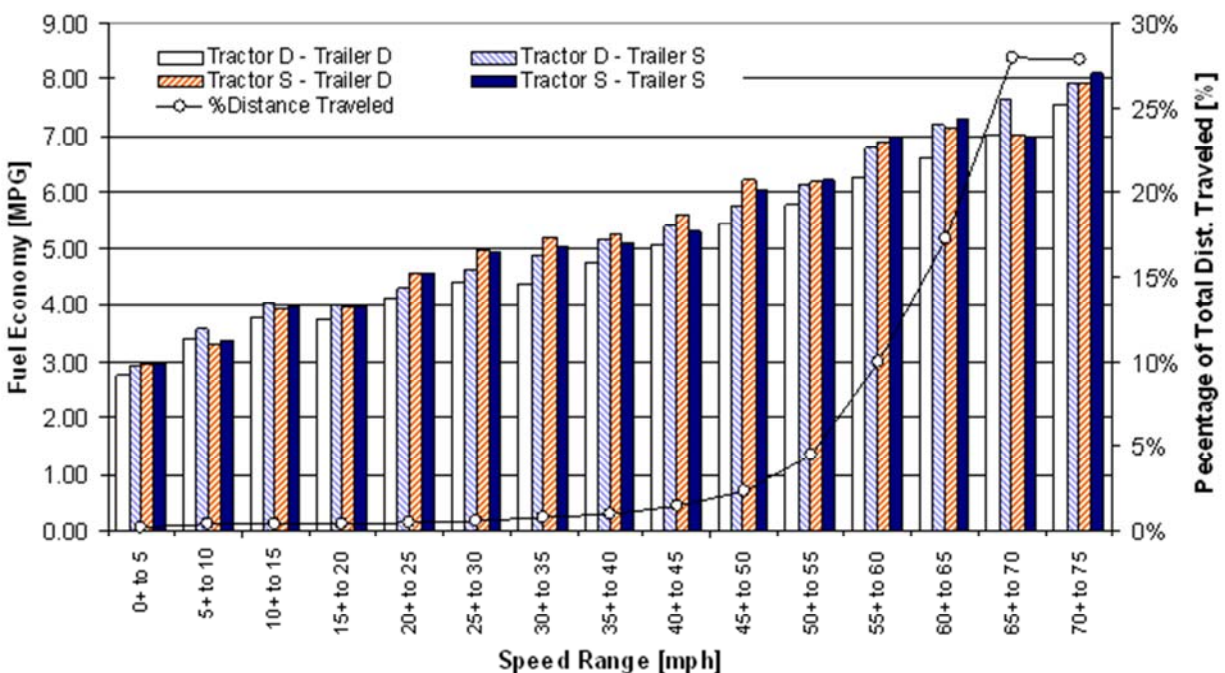
<sup>a</sup> Total Fuel Consumed does not include fuel consumed while idling.



The fuel economy information presented in Table 5.10 is on the upper limits of today's large-truck fleets and is mostly a result of driver training and the extensive vehicle maintenance (including constant tire pressure) to which the fleet company participating in this project adheres. Nevertheless, the results of this extensive test indicate that there are substantial gains in terms of fuel economy for large trucks when single (wide) tires are used in combination with dual tires or alone (best case). Figure 5.3 shows the information from Table 5.10 in a graphical form (bars) and also displays for each speed bin the percentage of the total distance that is traveled at that speed (line). It is possible to observe that above 80% of the distance traveled by long-haul Class 8 trucks is done at speeds above 55 mph. Therefore, any gains in fuel economies at these speeds derived from a given tire combination would have a very large impact on the overall fuel economy of these types of trucks. Figure 5.3 shows that, except for the D-S combination within the 65+ to 70 mph, the combinations with all single (wide) tires perform better and, therefore, obtain the largest overall fuel economy.

**Figure 5.3. Class 8 Truck Fuel Economy as a Function of Speed and Tractor-Trailer Tire Combination and Percentage of Total Distance Traveled as a Function of Speed**

**NOT ADJUSTED FOR TERRAIN: See note below.**



**Source:**

Capps, Gary, Oscar Franzese, Bill Knee, M.B. Lascrain, and Pedro Otaduy. *Class-8 Heavy Truck Duty Cycle Project Final Report*, ORNL/TM-2008/122, Oak Ridge National Laboratory, Oak Ridge, TN, December 2008.

**Note:** D = Dual tire. S = Single (wide) tire.

These data were not adjusted to account for the effects of terrain. The increase in fuel economy for speeds above 70 mph is likely due to the vehicle achieving high speeds while traveling down slope. Therefore, this increase in fuel economy is not expected to be characteristic of all travel at these higher speeds.

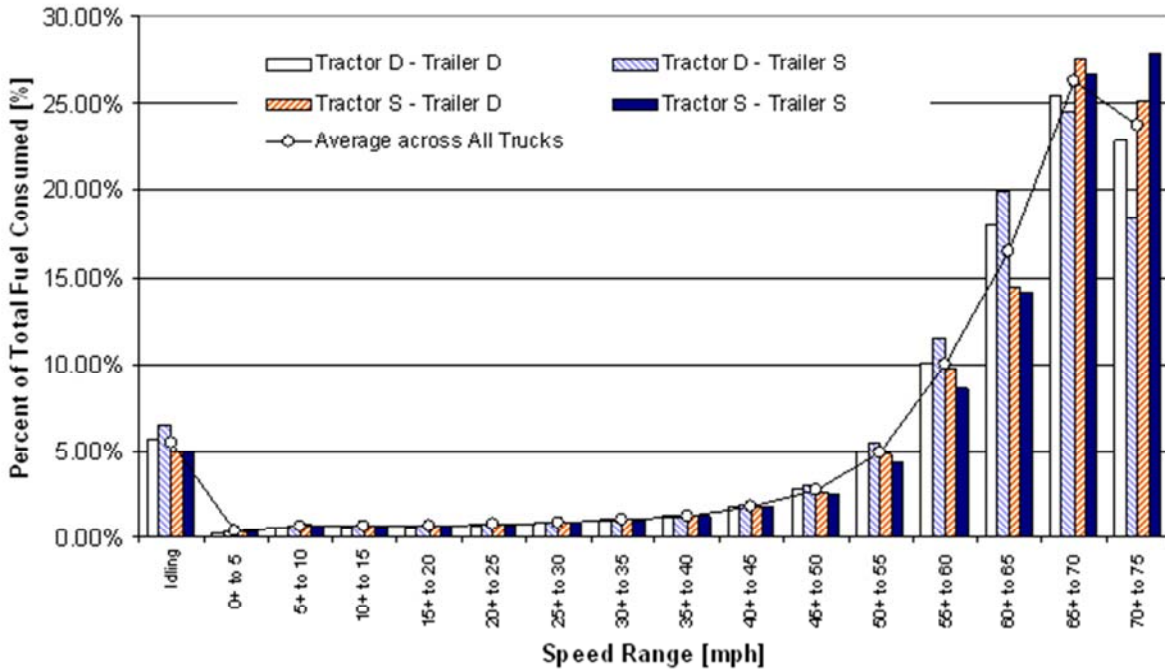




This graph presents for each one of the four tire-combination categories the percent of total fuel that is consumed when traveling at different speeds (bars) as well as the average percent of fuel consumed for each speed bin (line). As opposed to Table 5.10, the total fuel consumed on this graph includes the fuel consumed while idling.

**Figure 5.4. Class 8 Truck Percent of Total Fuel Consumed as a Function of Speed and Tractor-Trailer Tire Combination**

**NOT ADJUSTED FOR TERRAIN: See note below.**



**Source:**

Capps, Gary, Oscar Franzese, Bill Knee, M.B. Lascrain, and Pedro Otaduy. *Class-8 Heavy Truck Duty Cycle Project Final Report*, ORNL/TM-2008/122, Oak Ridge National Laboratory, Oak Ridge, TN, December 2008.

**Note:** D = Dual tire. S = Single (wide) tire.

These data were not adjusted to account for the effects of terrain. The increase in fuel economy for speeds above 70 mph is likely due to the vehicle achieving high speeds while traveling down slope. Therefore, this increase in fuel economy is not expected to be characteristic of all travel at these higher speeds.



*A typical class 8 truck tractor weighs about 17,000 lbs. The powertrain is nearly a quarter of the weight (24%) while the truck body structure is 19%.*

**Table 5.12**  
**Class 8 Truck Weight by Component**

|                           | Pounds | Share of Total |
|---------------------------|--------|----------------|
| Wheels and tires          | 1,700  | 10%            |
| Chassis/frame             | 2,040  | 12%            |
| Drivetrain and suspension | 2,890  | 17%            |
| Misc. accessories/systems | 3,060  | 18%            |
| Truck body structure      | 3,230  | 19%            |
| Powertrain                | 4,080  | 24%            |
| Total                     | 17,000 | 100%           |

**Source:**

National Academy of Sciences, *Technologies and Approaches to Reducing the Fuel Consumption of Medium and Heavy-Duty Vehicles*, prepublication copy, March 2010, p. 5-42.

**Notes:**

- Powertrain includes engine and cooling system, transmission and accessories.
- Truck body structure includes cab-in-white, sleeper unit, hood and fairings, interior and glass.
- Miscellaneous accessories/systems include batteries, fuel system, and exhaust hardware.
- Drivetrain and suspension includes drive axles, steer axle, and suspension system.
- Chassis/frame includes frame rails and crossmembers, fifth wheel and brackets. Wheels and tires include a set of 10 aluminum wheels, plus tires.





*The gross weight of a vehicle (GVW) is the weight of the empty vehicle plus the weight of the maximum payload that the vehicle was designed to carry. In cars and small light trucks, the difference between the empty weight of the vehicle and the GVW is not significantly different (1,000 to 1,500 lbs). The largest trucks and tractor-trailers, however, have a payload capacity share of 200%, which means they can carry 200% of their empty weight. The medium-sized trucks (truck classes 3-6) have payload capacity shares between 50% and 100%.*

**Table 5.13**  
**Gross Vehicle Weight vs. Empty Vehicle Weight**

| Vehicle Description   | Truck Class | Gross Vehicle Weight Range (pounds) | Empty Vehicle Weight Range (pounds) | Maximum Payload Capacity (pounds) | Payload Capacity Share (Percent of Empty Weight) |
|---|-------------|-------------------------------------|-------------------------------------|-----------------------------------|--|
| Cars  |             | 3,200-6,000                         | 2,400-5,000                         | 1,000                             | 20%  |
| Minivans, Small SUVs, Small Pick-Ups  | 1           | 4,000-2,400                         | 3,200-4,500                         | 1,500                             | 33%  |
| Large SUVs, Standard Pick-Ups   | 2a          | 6,001-8,500                         | 4,500-6,000                         | 2,500                             | 40%  |
| Large SUVs, Standard Pick-Ups   | 2b          | 8,501-10,000                        | 5,000-6,300                         | 3,700                             | 60%  |
| Utility Van, Multi- Purpose, Mini-Bus, Step Van   | 3           | 10,001-14,000                       | 7,650-8,750                         | 5,250                             | 60%  |
| City Delivery, Parcel Delivery, Large Walk-in, Bucket, Landscaping  | 4           | 14,001-16,000                       | 7,650-8,750                         | 7,250                             | 80%  |
| City Delivery, Parcel Delivery, Large Walk-in, Bucket   | 5           | 16,001-19,500                       | 9,500-10,000                        | 8,700                             | 80%  |
| City Delivery, School Bus, Large Walk-in, Bucket  | 6           | 19,501-26,000                       | 11,500-14,500                       | 11,500                            | 80%  |
| City Bus, Furniture, Refrigerated, Refuse, Fuel Tanker, Dump, Tow, Concrete, Fire Engine, Tractor-Trailer | 7           | 26,001-33,000                       | 11,500-14,500                       | 18,500                            | 125%   |
| Refuse, Concrete, Furniture, City Bus, Tow, Fire Engine (straight trucks)                                 | 8a          | 33,001-80,000                       | 20,000-26,000                       | 54,000                            | 200%   |
| Tractor-Trailer: Van, Refrigerated, Bulk Tanker, Flat Bed (combination trucks)                            | 8b          | 33,001-80,000                       | 20,000-26,000                       | 54,000                            | 200%   |

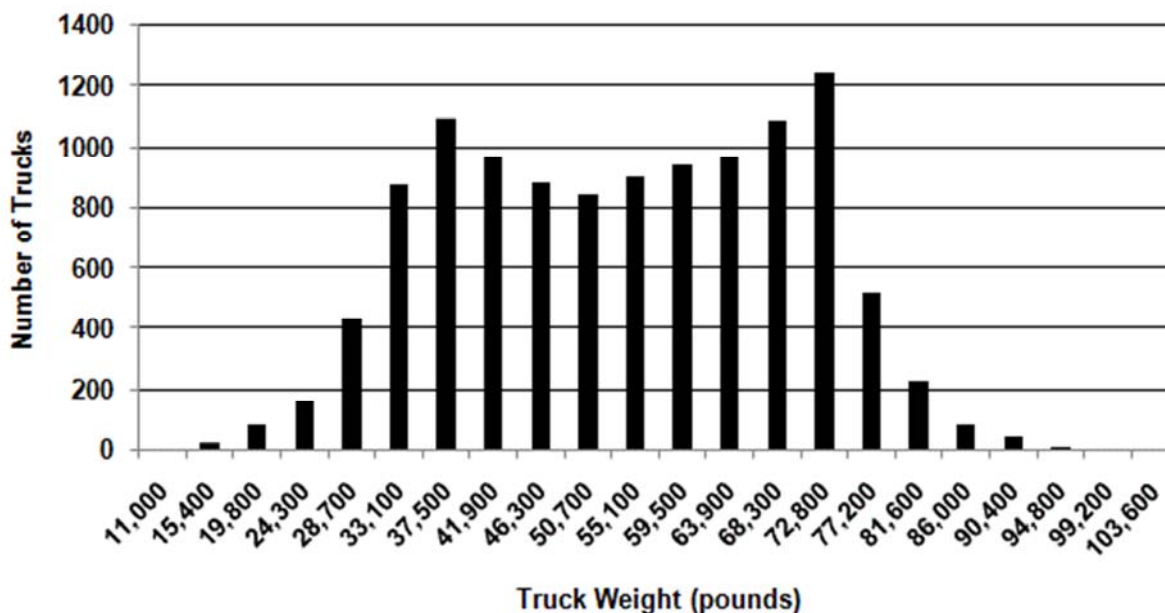
**Source:**

National Academy of Sciences, *Technologies and Approaches to Reducing the Fuel Consumption of Medium and Heavy-Duty Vehicles*, prepublication copy, March 2010, pp. 2-2 and 5-42.



According to weigh-in-motion data collected by fifteen states, the majority of 5-axle tractor-trailers on the road weigh between 33,000 and 73,000 lbs. Eleven percent of the tractor-trailers had weight recorded around 72,800 lbs and 10% around 68,300 lbs. Another 10% of tractor-trailers were on the lighter end of the scale – around 37,500 lbs. These data show that only a small percent of trucks on the road are near the maximum roadway gross vehicle weight of 80,000 lbs. Thus, most trucks are filling the trailer space to capacity (cubing-out) before they reach the maximum weight limit (weighing-out).

**Figure 5.5. Distribution of Five-Axle Tractor-Trailers by On-Road Vehicle Weight, 2008**



**Source:**

National Academy of Sciences, *Technologies and Approaches to Reducing the Fuel Consumption of Medium and Heavy-Duty Vehicles*, prepublication copy, March 2010, p. 5-45. Original source: Federal Highway Administration, Vehicle Travel Information System, 2008.

**Note:** Data are from these 15 States: California, Connecticut, Florida, Georgia, Hawaii, Iowa, Minnesota, Missouri, Montana, North Carolina, Oregon, Pennsylvania, South Dakota, Texas, and Washington.



## Commodity Flow Survey

The Commodity Flow Survey (CFS) is designed to provide data on the flow of goods and materials by mode of transport. The 1993, 1997, 2002, and 2007 CFS are a continuation of statistics collected in the Commodity Transportation Survey from 1963 through 1977, and include major improvements in methodology, sample size, and scope. The 2007 CFS covers business establishments with paid employees that are located in the United States and are classified using the North American Industry Classification System (NAICS) in mining, manufacturing, wholesale trade, and select retail trade industries, namely, electronic shopping and mail-order houses. Establishments classified in services, transportation, construction, and most retail industries are excluded from the survey. Farms, fisheries, foreign establishments, and most government-owned establishments are also excluded.<sup>a</sup>

The 1993, 1997, 2002, and 2007 CFS differ from previous surveys in their greatly expanded coverage of intermodalism (i.e., shipments which travel by at least two different modes, such as rail and truck). Earlier surveys reported only the principal mode. Route distance for each mode for each shipment was imputed using methodologies developed by Oak Ridge National Laboratory. Distance, in turn, was used to compute ton-mileage by mode of transport.

The data can be viewed at: [www.bts.gov/publications/commodity\\_flow\\_survey](http://www.bts.gov/publications/commodity_flow_survey).

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<sup>a</sup> Bureau of Transportation Statistics and U.S. Bureau of the Census, 2007 Economic Census, *2007 Commodity Flow Survey*, December 2008.



*Industries covered by the 2007 Commodity Flow Survey (CFS) shipped over 12 billion tons of goods worth over \$11 trillion. Compared to the 1997 CFS, the value of shipments is up 1.3% per year and tons shipped are up 1.6% per year. By value, intermodal shipments increased 4.7% per year from 1997 to 2007.*

**Table 5.14**  
**Growth of Freight in the United States: Comparison of the 1997, 2002 and**  
**2007 Commodity Flow Surveys**  
**(Detail may not add to total because of rounding)**

| Mode of Transportation         | Value of goods shipped               |                                      |                    |   | Tons               |                    |                    |  |
|--------------------------------|--------------------------------------|--------------------------------------|--------------------|---|--------------------|--------------------|--------------------|--|
|                                | 1997<br>(billion<br>2007<br>dollars) | 2002<br>(billion<br>2007<br>dollars) | 2007<br>(billions) | Average<br>annual<br>percent<br>change<br>(1997-2007) | 1997<br>(millions) | 2002<br>(millions) | 2007<br>(millions) | Average<br>annual<br>percent<br>change |
| <b>All modes</b>               | <b>8,970.5</b>                       | <b>9,678.0</b>                       | <b>11,684.9</b>    | <b>2.7%</b>   | <b>11,089.7</b>    | <b>11,667.9</b>    | <b>12,543.4</b>    | <b>1.2%</b>                            |
| <b>Single modes</b>            | <b>7,388.8</b>                       | <b>8,124.6</b>                       | <b>9,539.0</b>     | <b>2.6%</b>   | <b>10,436.5</b>    | <b>11,086.7</b>    | <b>11,698.1</b>    | <b>1.1%</b>                            |
| Truck <sup>a</sup>             | 6,435.3                              | 7,186.0                              | 8,335.8            | 2.6%  | 7,700.7            | 7,842.8            | 8,778.7            | 1.3%                                   |
| For-hire truck                 | 3,748.0                              | 4,330.2                              | 4,955.7            | 2.8%  | 3,402.6            | 3,657.3            | 4,075.1            | 1.8%                                   |
| Private truck                  | 2,630.8                              | 2,818.3                              | 3,380.1            | 2.5%  | 4,137.3            | 4,149.7            | 4,703.6            | 1.3%                                   |
| Rail                           | 412.9                                | 359.5                                | 436.4              | 0.6%  | 1,549.8            | 1,873.9            | 1,861.3            | 1.8%                                   |
| Water                          | 97.9                                 | 102.9                                | 114.9              | 1.6%  | 563.4              | 681.2              | 403.6              | -3.3%                                  |
| Shallow draft                  | 69.6                                 | 66.3                                 | 91.0               | 2.7%  | 414.8              | 458.6              | 343.3              | -1.9%                                  |
| Great Lakes                    | 1.9                                  | 0.9                                  | <sup>b</sup>       | <sup>b</sup>  | 38.4               | 38.0               | 17.8               | -7.4%                                  |
| Deep draft                     | 26.4                                 | 35.7                                 | 23.1               | -1.3%   | 110.2              | 184.6              | 42.5               | -9.1%                                  |
| Air (includes truck and air)   | 296.0                                | 305.4                                | 252.3              | -1.6%   | 4.5                | 3.8                | 3.6                | -2.2%                                  |
| Pipeline <sup>b</sup>          | 146.6                                | 172.0                                | 399.6              | 10.5%   | 618.2              | 685.0              | 650.9              | 0.5%                                   |
| <b>Multiple modes</b>          | <b>1,221.9</b>                       | <b>1,243.8</b>                       | <b>1,866.7</b>     | <b>4.3%</b>   | <b>216.7</b>       | <b>216.7</b>       | <b>573.7</b>       | <b>10.2%</b>                           |
| Parcel, U.S. Postal Service    |                                      |                                      |                    |   |                    |                    |                    |  |
| or courier                     | 1,105.7                              | 1,138.5                              | 1,561.9            | 3.5%  | 23.7               | 25.5               | 33.9               | 3.6%                                   |
| Truck and rail                 | 97.8                                 | 80.6                                 | 187.2              | 6.7%  | 54.2               | 43.0               | 225.6              | 15.3%                                  |
| Truck and water                | 10.6                                 | 16.6                                 | 58.4               | 18.6%   | 33.2               | 23.3               | 145.5              | 15.9%                                  |
| Rail and water                 | 2.3                                  | 3.8                                  | 13.9               | 19.7%   | 79.3               | 105.1              | 54.9               | -3.6%                                  |
| Other multiple modes           | 5.6                                  | 4.4                                  | 45.3               | -8.0%   | 26.2               | 19.8               | 113.8              | 15.8%                                  |
| <b>Other and unknown modes</b> | <b>359.9</b>                         | <b>309.6</b>                         | <b>279.1</b>       | <b>-2.5%</b>  | <b>436.5</b>       | <b>364.6</b>       | <b>271.6</b>       | <b>-4.6%</b>                           |

**Source:**

U.S. Department of Transportation, Bureau of Transportation Statistics and U.S. Department of Commerce, Bureau of the Census, *2007 Commodity Flow Survey*, Table 1a. (Additional resources: [www.bts.gov/cfs](http://www.bts.gov/cfs))

<sup>a</sup> "Truck" as a single mode includes shipments which went by private truck only, for-hire truck only, or a combination of private truck and for-hire truck.

<sup>b</sup> Denotes data do not meet publication standards because of high sampling variability or poor response quality.

<sup>c</sup> CFS data for pipeline exclude most shipments of crude oil.



*Industries covered by the 2007 Commodity Flow Survey (CFS) accounted for 3.3 trillion ton-miles on the nation's highways, railways, waterways, pipelines, and aviation system. Ton-miles increased an average of 2.7% per year from 1997 to 2007.*

**Table 5.15**  
**Growth of Freight Miles in the United States: Comparison of the 1997, 2002 and**  
**2007 Commodity Flow Surveys**  
**(Detail may not add to total because of rounding)**

| Mode of Transportation         | Ton-miles          |                    |                    |   | Average miles per shipment |              |              |  |
|--------------------------------|--------------------|--------------------|--------------------|---|----------------------------|--------------|--------------|--|
|                                | 1997<br>(billions) | 2002<br>(billions) | 2007<br>(billions) | Average<br>annual<br>percent<br>change<br>(1997-2007) | 1997                       | 2002         | 2007         | Average<br>annual<br>percent<br>change |
| <b>All modes</b>               | <b>2,661.4</b>     | <b>3,137.9</b>     | <b>3,344.7</b>     | <b>2.3%</b>   | <b>472</b>                 | <b>546</b>   | <b>619</b>   | <b>2.7%</b>                            |
| <b>Single modes</b>            | <b>2,383.5</b>     | <b>2,867.9</b>     | <b>2,894.3</b>     | <b>2.0%</b>   | <b>184</b>                 | <b>240</b>   | <b>234</b>   | <b>2.4%</b>                            |
| Truck <sup>a</sup>             | 1,023.5            | 1,255.9            | 1,342.1            | 2.7%  | 144                        | 173          | 206          | 3.6%                                   |
| For-hire truck                 | 741.1              | 959.6              | 1,055.6            | 3.6%  | 485                        | 523          | 599          | 2.1%                                   |
| Private truck                  | 268.6              | 291.1              | 286.5              | 0.6%  | 53                         | 64           | 57           | 0.7%                                   |
| Rail                           | 1,022.5            | 1,261.6            | 1,344.0            | 2.8%  | 769                        | 807          | 728          | -0.5%                                  |
| Water                          | 261.7              | 282.7              | 157.3              | -5.0%   | 482                        | 568          | 520          | 0.8%                                   |
| Shallow draft                  | 189.3              | 211.5              | 117.5              | -4.7%   | 177                        | 450          | 144          | -2.0%                                  |
| Great Lakes                    | 13.4               | 13.8               | 6.9                | -6.4%   | 204                        | 339          | 657          | 12.4%                                  |
| Deep draft                     | 59.0               | 57.4               | 33.0               | -0.1%   | 1,024                      | 664          | 923          | -1.0%                                  |
| Air (includes truck and air)   | 6.2                | 5.8                | 4.5                | -3.2%   | 1,380                      | 1,919        | 1,304        | -0.6%                                  |
| Pipeline <sup>b</sup>          | <sup>c</sup>       | <sup>c</sup>       | <sup>c</sup>       | <sup>c</sup>  | <sup>c</sup>               | <sup>c</sup> | <sup>c</sup> | <sup>c</sup>                           |
| <b>Multiple modes</b>          | <b>204.5</b>       | <b>225.7</b>       | <b>416.6</b>       | <b>7.4%</b>   | <b>813</b>                 | <b>895</b>   | <b>975</b>   | <b>1.8%</b>                            |
| Parcel, U.S. Postal Service    |                    |                    |                    |   |                            |              |              |  |
| or courier                     | 18.0               | 19.0               | 28.0               | 4.5%  | 813                        | 894          | 975          | 1.8%                                   |
| Truck and rail                 | 55.6               | 45.5               | 196.8              | 13.5%   | 1,347                      | 1,413        | 1,007        | -2.9%                                  |
| Truck and water                | 34.8               | 32.4               | 98.4               | 11.0%   | 1,265                      | 1,950        | 1,429        | 1.2%                                   |
| Rail and water                 | 77.6               | 115.0              | 47.1               | -4.9%   | 1,092                      | 957          | 1,928        | 5.8%                                   |
| Other multiple modes           | 18.6               | 13.8               | 46.4               | 0.1%  | <sup>c</sup>               | <sup>c</sup> | 1,182        | <sup>c</sup>                           |
| <b>Other and unknown modes</b> | <b>73.4</b>        | <b>44.2</b>        | <b>33.8</b>        | <b>-7.5%</b>  | <b>122</b>                 | <b>130</b>   | <b>116</b>   | <b>-0.5%</b>                           |

**Source:**

U.S. Department of Transportation, Bureau of Transportation Statistics and U.S. Department of Commerce, Bureau of the Census, *2007 Commodity Flow Survey*, Table 1a. (Additional resources: [www.bts.gov/cfs](http://www.bts.gov/cfs))

<sup>a</sup> "Truck" as a single mode includes shipments which went by private truck only, for-hire truck only, or a combination of private truck and for-hire truck.

<sup>b</sup> CFS data for pipeline exclude most shipments of crude oil.

<sup>c</sup> Denotes data do not meet publication standards because of high sampling variability or other reasons. Some unpublished estimates can be derived from other data published in this table. However, figures obtained in this manner are subject to these same limitations.



*In 2007, the data changed substantially due to improved estimation methodologies. Unfortunately, those data are no longer comparable to the rest of the historical series.*

**Table 5.16**  
**Summary Statistics on Transit Buses and Trolleybuses, 1994–2009**

| Year              | Number of<br>active buses | Vehicle-miles<br>(millions) | Passenger-<br>miles<br>(millions) | Btu/passenger-mile | Energy use<br>(trillion Btu) |
|-------------------|---------------------------|-----------------------------|-----------------------------------|--------------------|------------------------------|
| 1994              | 68,766                    | 2,176                       | 19,019                            | 4,262              | 81.1                         |
| 1995              | 67,802                    | 2,198                       | 19,005                            | 4,307              | 81.9                         |
| 1996              | 72,353                    | 2,234                       | 19,280                            | 4,340              | 83.7                         |
| 1997              | 73,425                    | 2,259                       | 19,793                            | 4,434              | 87.8                         |
| 1998              | 72,788                    | 2,188                       | 20,542                            | 4,399              | 90.4                         |
| 1999              | 74,885                    | 2,290                       | 21,391                            | 4,344              | 92.9                         |
| 2000              | 75,665                    | 2,329                       | 21,433                            | 4,531              | 97.1                         |
| 2001              | 76,675                    | 2,389                       | 22,209                            | 4,146              | 92.1                         |
| 2002              | 76,806                    | 2,425                       | 22,029                            | 4,133              | 91.1                         |
| 2003              | 78,000                    | 2,435                       | 21,438                            | 4,213              | 90.3                         |
| 2004              | 81,630                    | 2,484                       | 21,550                            | 4,364              | 94.0                         |
| 2005              | 82,642                    | 2,498                       | 21,998                            | 4,250              | 93.5                         |
| 2006              | 83,689                    | 2,507                       | 22,985                            | 4,316              | 99.2                         |
| 2007 <sup>a</sup> | 65,808                    | 2,314                       | 21,132                            | 4,372              | 92.4                         |
| 2008              | 67,096                    | 2,388                       | 21,918                            | 4,348              | 95.3                         |
| 2009              | 65,363                    | 2,345                       | 21,645                            | 4,242              | 91.8                         |

**Source:**

American Public Transportation Association, *2011 Public Transportation Fact Book*, Washington, DC, April 2011, Tables 6, 8, 9, and 15. (Additional resources: [www.apta.com](http://www.apta.com))

<sup>a</sup> Data are not continuous between 2006 and 2007 due to changes in estimation methodology. See source document for details.



## Chapter 6

# Alternative Fuel and Advanced Technology Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

| Source    |   |         |
|-----------|---|---------|
| Table 6.1 | Alternative fuel vehicles in use, 2009        | 826,315 |
|           | <i>E85</i>                                    | 504,297 |
|           | <i>LPG</i>                                    | 147,030 |
|           | <i>CNG</i>                                    | 114,270 |
|           | <i>Electric</i>                               | 57,185  |
|           | <i>LNG</i>                                    | 3,176   |
|           | <i>M85</i>                                    | 0       |
| Table 6.4 | Number of alternative fuel refuel sites, 2011 | 7,183   |
|           | <i>LPG</i>                                    | 2,589   |
|           | <i>CNG</i>                                    | 873     |
|           | <i>Electric</i>                               | 687     |
|           | <i>Biodiesel</i>                              | 610     |
|           | <i>Hydrogen</i>                               | 58      |

*Fuel type abbreviations are used throughout this chapter.*

|                      |   |                                     |
|----------------------|---|-------------------------------------|
| <i>B20</i>           | = | 20% biodiesel, 80% petroleum diesel |
| <i>CNG</i>           | = | compressed natural gas              |
| <i>E85</i>           | = | 85% ethanol, 15% gasoline           |
| <i>E95</i>           | = | 95% ethanol, 5% gasoline            |
| <i>H<sub>2</sub></i> | = | hydrogen                            |
| <i>LNG</i>           | = | liquefied natural gas               |
| <i>LPG</i>           | = | liquefied petroleum gas             |
| <i>M85</i>           | = | 85% methanol, 15% gasoline          |
| <i>M100</i>          | = | 100% methanol                       |



## Alternative Fuels

The Energy Policy Act of 1992 defines alternative fuels and allows the U.S. Department of Energy (DOE) to add to the list of alternative fuels if the fuel is substantially nonpetroleum, yields substantial energy security benefits, and offers substantial environmental benefits. DOE currently recognizes the following as alternative fuels:

- methanol, ethanol, and other alcohols,
- blends of 85% or more of alcohol with gasoline,
- natural gas and liquid fuels domestically produced from natural gas,
- liquefied petroleum gas (propane),
- coal-derived liquid fuels,
- hydrogen,
- electricity,
- biodiesel (BIOO),
- fuels (other than alcohol) derived from biological materials,
- P-series.

## Alternative Fuels & Advanced Vehicles Data Center

DOE established the Alternative Fuels Data Center (AFDC) in 1991 to support its work aimed at fulfilling the Alternative Motor Fuels Act directives. Since then, the AFDC has expanded its focus to include all advanced transportation fuels, vehicles, and technologies. It has been renamed the Alternative Fuels & Advanced Vehicles Data Center to reflect this broader scope. The AFDC is operated and managed by the National Renewable Energy Laboratory (NREL) in Golden, Colorado.

The purposes of the AFDC are:

- to gather and analyze information on the fuel consumption, emissions, operation, and durability of alternative fuel vehicles, and
- to provide unbiased, accurate information on alternative fuels and alternative fuel vehicles to government agencies, private industry, research institutions, and other interested organizations.

Much of the AFDC data can be obtained through their Web site: **[www.eere.energy.gov/afdc](http://www.eere.energy.gov/afdc)**. Several tables and graphs in this chapter contain statistics which were generated by the AFDC. Below are some links to specific areas of the AFDC Web site.

**Alternative & Advanced Fuels** - [www.eere.energy.gov/afdc/fuels/index.html](http://www.eere.energy.gov/afdc/fuels/index.html)

**Alternative Fueling Station Locator** - [www.eere.energy.gov/afdc/fuels/stations\\_locator.html](http://www.eere.energy.gov/afdc/fuels/stations_locator.html)

**Alternative & Advanced Vehicles** - [www.eere.energy.gov/afdc/vehicles/index.html](http://www.eere.energy.gov/afdc/vehicles/index.html)

**Fleet Information** - [www.eere.energy.gov/afdc/fleets/index.html](http://www.eere.energy.gov/afdc/fleets/index.html)

**State & Federal Incentives & Laws** - [www.eere.energy.gov/afdc/incentives\\_laws.html](http://www.eere.energy.gov/afdc/incentives_laws.html)

**Data Analysis & Trends** - [www.eere.energy.gov/afdc/data/index.html](http://www.eere.energy.gov/afdc/data/index.html)





*There are over 826,000 alternative fuel vehicles in the United States, not including flex-fuel E85 vehicles which operate mainly on gasoline. The E85 vehicles in this table are those believed to be regularly fueled with E85.*

**Table 6.1**  
**Estimates of Alternative Fuel Vehicles in Use<sup>a</sup>, 1995–2009**

| Year                                    | LPG     | CNG     | LNG   | M85     | M100    | E85 <sup>b</sup> | E95     | Electricity <sup>c</sup> | Hydrogen | Total          |
|---|---------|---------|-------|---------|---------|------------------|---------|--------------------------|----------|----------------|
| 1995                                    | 172,806 | 50,218  | 603   | 18,319  | 386     | 1,527            | 136     | 2,860                    | 0        | <b>246,855</b> |
| 1996                                    | 175,585 | 60,144  | 663   | 20,265  | 172     | 4,536            | 361     | 3,280                    | 0        | <b>265,006</b> |
| 1997                                    | 175,679 | 68,571  | 813   | 21,040  | 172     | 9,130            | 347     | 4,453                    | 0        | <b>280,205</b> |
| 1998                                    | 177,183 | 78,782  | 1,172 | 19,648  | 200     | 12,788           | 14      | 5,243                    | 0        | <b>295,030</b> |
| 1999                                    | 178,610 | 91,267  | 1,681 | 18,964  | 198     | 24,604           | 14      | 6,964                    | 0        | <b>322,302</b> |
| 2000                                    | 181,994 | 100,750 | 2,090 | 10,426  | 0       | 87,570           | 4       | 11,830                   | 0        | <b>394,664</b> |
| 2001                                    | 185,053 | 111,851 | 2,576 | 7,827   | 0       | 100,303          | 0       | 17,847                   | 0        | <b>425,457</b> |
| 2002                                    | 187,680 | 120,839 | 2,708 | 5,873   | 0       | 120,951          | 0       | 33,047                   | 0        | <b>471,098</b> |
| 2003                                    | 190,369 | 114,406 | 2,640 | 0       | 0       | 179,090          | 0       | 47,485                   | 9        | <b>533,999</b> |
| 2004                                    | 182,864 | 118,532 | 2,717 | 0       | 0       | 211,800          | 0       | 49,536                   | 43       | <b>565,492</b> |
| 2005                                    | 173,795 | 117,699 | 2,748 | 0       | 0       | 246,363          | 0       | 51,398                   | 119      | <b>592,122</b> |
| 2006                                    | 164,846 | 116,131 | 2,798 | 0       | 0       | 297,099          | 0       | 53,526                   | 159      | <b>634,559</b> |
| 2007                                    | 158,254 | 114,391 | 2,781 | 0       | 0       | 364,384          | 0       | 55,730                   | 223      | <b>695,763</b> |
| 2008                                    | 151,049 | 113,973 | 3,101 | 0       | 0       | 450,327          | 0       | 56,901                   | 313      | <b>775,664</b> |
| 2009                                    | 147,030 | 114,270 | 3,176 | 0       | 0       | 504,297          | 0       | 57,185                   | 357      | <b>826,315</b> |
| <i>Average annual percentage change</i> |         |         |       |         |         |                  |         |                          |          |                |
| 1995-2009                               | -1.1%   | 6.0%    | 12.6% | -100.0% | -100.0% | 51.3%            | -100.0% | 23.9%                    |          | <b>9.0%</b>    |

**Source:**

U. S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels*, 2009, Washington, DC, May 2011, Table VI. 1995-2006, *Annual Energy Review*, Table 10.4. Estimated Number of Alternative-Fueled Vehicles in Use and Replacement Fuel Consumption. (Additional resources: [www.eia.doe.gov/emeu/aer/renew.html](http://www.eia.doe.gov/emeu/aer/renew.html) and [www.eere.energy.gov/afdc/data/vehicles.html](http://www.eere.energy.gov/afdc/data/vehicles.html))

<sup>a</sup> Vehicles in Use represent accumulated acquisitions, less retirements, as of the end of each calendar year. They do not include concept and demonstration vehicles.

<sup>b</sup> Includes only those E85 vehicles believed to be used as alternative-fuels vehicles (AFVs), primarily fleet-operated vehicles; excludes other vehicles with E85-fueling capability. In 1997, some vehicle manufacturers began including E85-fueling capability in certain model lines of vehicles. For 2007, the Energy Information Administration (EIA) estimates that the number of E85 vehicles that are capable of operating on E85, motor gasoline, or both, is about 7.1 million. Many of these AFVs are sold and used as traditional gasoline-powered vehicles.

<sup>c</sup> Excludes HEVs.



*Trolleybus, heavy rail, and light rail use nearly all alternative fuels. However, the 33.5% of buses using alternative fuels replace a lot of traditional fuel use. Rail transit vehicles have the highest average age.*

**Table 6.2**  
**Alternative Fuel Transit Vehicles, 2009**

| Mode          | Average Age | Percent Powered by Alternative Fuels | Number Of Vehicles |
|---------------|-------------|--------------------------------------|--------------------|
| Bus           | 7.5         | 33.5%                                | 64,832             |
| Commuter Rail | 20.5        | 11.3%                                | 6,941              |
| Ferry Boat    | 17.8        | 47.6%                                | 194                |
| Heavy Rail    | 21.9        | 100.0%                               | 11,461             |
| Light Rail    | 15.8        | 98.3%                                | 2,068              |
| Paratransit   | 3.5         | 8.0%                                 | 68,957             |
| Trolleybus    | 8.9         | 100.0%                               | 531                |
| Vanpool       | 4.0         | 2.8%                                 | 12,013             |

**Source:**

American Public Transportation Association, *2011 Public Transportation Fact Book*, Washington, DC, April 2011, Tables 9 and 10, and historical tables 51 and 52. (Additional resources: [www.apta.com](http://www.apta.com))

**Note:** See Glossary for definition of modes, such as paratransit and vanpool.



**Table 6.3**  
**Alternative Fuel Vehicles Available by Manufacturer, Model Year 2011**

| Model   | Fuel               | Type       | Emission Class        |
|---|--------------------|------------|-----------------------|
| <b>Bentley: 1-800-777-6923; www.bentleymotors.com</b>                   |                    |            |                       |
| Continental Supersports   | E85 flex fuel      | Two-seater | Tier 2 Bin 5          |
| Continental GTC   | E85 flex fuel      | Sedan      | Tier 2 Bin 5          |
| Continental Flying Spur   | E85 flex fuel      | Sedan      | Tier 2 Bin 5          |
| <b>Chrysler: 1-800-999-FLEET; www.fleet.chrysler.com</b>                |                    |            |                       |
| Chrysler 200  | E85 flex fuel      | Sedan      | N/A                   |
| Chrysler 300  | E85 flex fuel      | Sedan      | N/A                   |
| Chrysler Town & Country   | E85 flex fuel      | Minivan    | Tier 2 Bin 4          |
| Dodge Avenger   | E85 flex fuel      | Sedan      | N/A                   |
| Dodge Charger   | E85 flex fuel      | Sedan      | N/A                   |
| Dodge Grand Caravan FWD   | E85 flex fuel      | Minivan    | Tier 2 Bin 4          |
| Dodge Dakota 2WD, 4WD   | E85 flex fuel      | Pickup     | Tier 2 Bin 4          |
| Dodge Durango   | E85 flex fuel      | SUV        | N/A                   |
| Dodge Journey   | E85 flex fuel      | SUV        | N/A                   |
| Dodge Ram 1500 2WD, 4WD   | E85 flex fuel      | Pickup     | Tier 2 Bin 4          |
| Jeep Grand Cherokee 2WD, 4WD  | E85 flex fuel      | SUV        | Tier 2 Bin 5          |
| <b>Ford: 1-800-34-FLEET; www.fleet.ford.com; www.fordvehicles.com</b>   |                    |            |                       |
| Ford E350 FFV 2WD   | E85 flex fuel      | Van        | Tier 2 Bin 8          |
| Ford Escape 4WD   | E85 flex fuel      | SUV        | Tier 2 Bin 4          |
| Ford F250 FFV 4WD   | E85 flex fuel      | Pickup     | Tier 2 Bin 8          |
| Ford Fusion 2WD   | E85 flex fuel      | Sedan      | Tier 2 Bin 5          |
| Crown Victoria Police   | E85 flex fuel      | Sedan      | Tier 2 Bin 4          |
| Lincoln Town Car  | E85 flex fuel      | Sedan      | Tier 2 Bin 4          |
| Mercury Grand Marquis   | E85 flex fuel      | Sedan      | Tier 2 Bin 4          |
| Mercury Mariner FWD   | E85 flex fuel      | SUV        | Tier 2 Bin 4          |
| Mercury Milan AWD   | E85 flex fuel      | Sedan      | Tier 2 Bin 5          |
| Ford E-Series E150 Van  | E85 flex fuel      | Van        | Tier 2 Bin 8          |
| Ford Expedition   | E85 flex fuel      | SUV        | Tier 2 Bin 5          |
| Ford F-150  | E85 flex fuel      | Pickup     | Tier 2 Bin 5          |
| Lincoln Navigator 4WD   | E85 flex fuel      | SUV        | Tier 2 Bin 5          |
| <b>General Motors Corporation: 1-888-GM-AFT-4U; www.gm.com/vehicles</b> |                    |            |                       |
| Buick Lucerne CXL   | E85 flex fuel      | Sedan      | Tier 2 Bin 4          |
| Buick Regal CXL Turbo   | E85 flex fuel      | Sedan      | Tier 2 Bin 4          |
| Cadillac Escalade AWD, 4WD  | E85 flex fuel      | SUV        | Tier 2 Bin 5          |
| Chevrolet Avalanche 1500 4WD  | E85 flex fuel      | SUV        | Tier 2 Bin 5          |
| Chevrolet Equinox AWD   | E85 flex fuel      | SUV        | N/A                   |
| Chevrolet Express   | E85 flex fuel      | Van        | Tier 2 Bin 5          |
| Chevrolet Express 2500 2WD  | E85 flex fuel      | Van        | Tier 2 Bin 5          |
| Chevrolet Express 3500 2WD  | E85 flex fuel      | Van        | Tier 2 Bin 5          |
| Chevrolet HHR   | E85 flex fuel      | SUV        | Tier 2 Bin 4          |
| Chevrolet Impala  | E85 flex fuel      | Sedan      | Tier 2 Bin 4          |
| Chevrolet Malibu LS   | E85 flex fuel      | Sedan      | Tier 2 Bin 4          |
| Chevrolet Silverado C15 2WD, 4WD  | E85 flex fuel      | Pickup     | Tier 2 Bin 5          |
| Chevrolet Suburban 1500 4WD   | E85 flex fuel      | SUV        | Tier 2 Bin 5          |
| Chevrolet Tahoe 1500 2WD, 4WD   | E85 flex fuel      | SUV        | Tier 2 Bin 5          |
| GMC Sierra C15 4WD  | E85 flex fuel      | Pickup     | Tier 2 Bin 5          |
| GMC Savana  | E85 flex fuel      | Van        | Tier 2 Bin 5          |
| GMC Savana 2500 2WD   | E85 flex fuel      | Van        | Tier 2 Bin 5          |
| GMC Terrain SLE-2 AWD   | E85 flex fuel      | SUV        | Tier 2 Bin 4          |
| GMC Yukon 1500 2WD, 4WD   | E85 flex fuel      | SUV        | Tier 2 Bin 5          |
| <b>Honda: 1-888-CC-HONDA; www.honda.com</b>                             |                    |            |                       |
| Civic GX  | CNG Dedicated      | Sedan      | AT-PZEV, Tier 2 Bin 2 |
| FCX   | Hydrogen fuel cell | Sedan      | ZEV, Tier 2 Bin 1     |
| <b>Mazda: 1-800-866-1998; www.mazdausa.com</b>                          |                    |            |                       |
| Tribute 2WD FFV   | E85 flex fuel      | SUV        | Tier 2 Bin 4          |

Continued on next page.



**Table 6.3 (continued)**  
**Alternative Fuel Vehicles Available by Manufacturer, Model Year 2011**

|   |               |            |                           |
|---|---------------|------------|---------------------------|
| <b>Mercedes-Benz USA: 1-800-FOR-MERCEDES; www.mbusa.com</b> |               |            |                           |
| C300 Sport  | E85 flex fuel | Sedan      | LEV II, LEV, Tier 2 Bin 5 |
| <b>Nissan: 1-800-NISSAN-1; www.nissanusa.com</b>            |               |            |                           |
| Armada 4WD  | E85 flex fuel | SUV        | LEV II, LEV, Tier 2 Bin 5 |
| Leaf  | Electric      | Sedan      | ZEV, Tier 2 Bin 1         |
| Titan   | E85 flex fuel | Pickup     | LEV II, LEV, Tier 2 Bin 5 |
| <b>Tesla Motors: 1-650-681-5000; www.teslamotors.com</b>    |               |            |                           |
| Roadster 2.5  | Electric      | Two-seater | ZEV, Tier 2 Bin 1         |
| <b>Toyota: 1-800-331-4331; www.toyota.com</b>               |               |            |                           |
| Sequoia 4WD   | E85 flex fuel | SUV        | Tier 2 Bin 5              |
| Tundra 4WD  | E85 flex fuel | Pickup     | Tier 2 Bin 5              |

**Source:**

U.S. Department of Energy, National Alternative Fuels Data Center, Web site,  
[www.afdc.energy.gov/afdc/vehicles/index.html](http://www.afdc.energy.gov/afdc/vehicles/index.html), February 2011. (Additional resources:  
[www.eere.energy.gov/afdc/vehicles/index.html](http://www.eere.energy.gov/afdc/vehicles/index.html))

**Note:** LEV=low emission vehicle. ILEV=inherently low emission vehicle. ULEV=ultra low emission vehicle. ZEV=zero emission vehicle. TLEV=transitional low emission vehicle. SULEV=super ultra low emission vehicle. See Chapter 12 for details on emissions.



**Table 6.4**  
**Hybrid Electric Vehicles Available by Manufacturer, Model Year 2011**

| Model   | Battery Type <sup>a</sup> | Type       | Emission Class             |
|---|---------------------------|------------|----------------------------|
| <b>BMW: 1-800-831-1117; www.bmwusa.com</b>                            |                           |            |                            |
| ActiveHybrid 7  | 126V Li-ion               | Sedan      | Tier 2 Bin 5               |
| ActiveHybrid 7L   | 126V Li-ion               | Sedan      | Tier 2 Bin 5               |
| ActiveHybrid X6   | NiMH                      | SUV        | Tier 2 Bin 5               |
| <b>Ford: 1-800-34-FLEET; www.fleet.ford.com; www.fordvehicles.com</b> |                           |            |                            |
| Ford Escape Hybrid  | NiMH                      | SUV        | LEVII, SULEV, Tier 2 Bin 3 |
| Ford Fusion Hybrid  | NiMH                      | Sedan      | PZEV, Tier 2 Bin 3         |
| Lincoln MKZ FWD   | NiMH                      | Sedan      | LEVII, SULEV, Tier 2 Bin 3 |
| Mercury Mariner Hybrid  | NiMH                      | SUV        | LEVII, SULEV, Tier 2 Bin 3 |
| Mercury Milan FWD Hybrid  | NiMH                      | Sedan      | LEVII, SULEV, Tier 2 Bin 3 |
| <b>General Motors: 1-888-GM-AFT-4U; www.gm.com/vehicles</b>           |                           |            |                            |
| Cadillac Escalade Hybrid 2WD, 4WD                                     | NiMH                      | SUV        | Tier 2 Bin 5               |
| Chevrolet Silverado 1500 Hybrid 2WD, 4WD                              | NiMH                      | Pickup     | Tier 2 Bin 5               |
| Chevrolet Tahoe 1500 Hybrid 2WD, 4WD                                  | NiMH                      | SUV        | Tier 2 Bin 5               |
| Chevrolet Volt  | Extended Range PHEV       | Sedan      | ULEV                       |
| GMC Sierra 15 Hybrid  | NiMH                      | Pickup     | Tier 2 Bin 5               |
| GMC Yukon 1500 Hybrid 2WD, 4WD  | NiMH                      | SUV        | Tier 2 Bin 5               |
| <b>Honda: 1-888-CC-HONDA; www.honda.com</b>                           |                           |            |                            |
| Civic Hybrid  | NiMH                      | Sedan      | PZEV, Tier 2 Bin 2         |
| CR-Z  | NiMH                      | Two-seater | AT-PZEV                    |
| Insight LX  | NiMH                      | Sedan      | Tier 2 Bin 3               |
| <b>Hyundai: 1-800-633-5151; www.hyundaiusa.com</b>                    |                           |            |                            |
| Sonata  | Li-Polymer                | Sedan      | N/A                        |
| <b>Lexus: 1-800-255-3987; www.lexus.com</b>                           |                           |            |                            |
| Lexus CT 200h   | HEV                       | Sedan      | N/A                        |
| Lexus GS 450h RWD   | HEV                       | Sedan      | LEVII, SULEV, Tier 2 Bin 3 |
| Lexus HS 250h   | HEV                       | Sedan      | LEVII, SULEV, Tier 2 Bin 3 |
| Lexus LS 600h L   | HEV                       | Sedan      | N/A                        |
| Lexus RX 450h 2WD   | HEV                       | SUV        | LEVII, SULEV, Tier 2 Bin 3 |
| <b>Mercedes-Benz USA: 1-800-FOR-MERCEDES; www.mbusa.com</b>           |                           |            |                            |
| ML450 4Matic Hybrid   | HEV                       | Sedan      | LEVII, SULEV, Tier 2 Bin 4 |
| S400 Hybrid   | HEV                       | Sedan      | LEVII, SULEV, Tier 2 Bin 4 |
| <b>Nissan: 1-800-NISSAN-1; www.nissanusa.com</b>                      |                           |            |                            |
| Altima Hybrid   | NiMH                      | Sedan      | PZEV, Tier 2 Bin 3         |
| <b>Toyota: 1-800-331-4331; www.toyota.com</b>                         |                           |            |                            |
| Camry Hybrid  | NiMH                      | Sedan      | LEVII, SULEV, Tier 2 Bin 3 |
| Highlander Hybrid   | NiMH                      | SUV        | LEVII, SULEV, Tier 2 Bin 3 |
| Prius Hybrid  | NiMH                      | Sedan      | AT-PZEV, Tier 2 Bin 3      |
| <b>Volkswagen: 1-800-DRIVE VW; www.volkswagen.com</b>                 |                           |            |                            |
| Touareg Hybrid  | NiMH                      | SUV        | N/A                        |

**Source:**

U.S. Department of Energy, National Alternative Fuels Data Center, Web site,  
[www.afdc.energy.gov/afdc/vehicles/index.html](http://www.afdc.energy.gov/afdc/vehicles/index.html), February 2011 (Additional resources:  
[www.eere.energy.gov/afdc/progs\\_vehicles\\_search.php](http://www.eere.energy.gov/afdc/progs_vehicles_search.php))

**Note:** LEV = low emission vehicle; ILEV = inherently low emission vehicle; ULEV = ultra low emission vehicle; ZEV = zero emission vehicle; TLEV = transitional low emission vehicle; SULEV = super ultra low emission vehicle; AT-PZEV = advanced technology - partial zero emissions vehicle. See Chapter 12 for details on emissions.

<sup>a</sup> NiMH = Nickel-Metal Hydride; PbA = Lead-Acid; Mild hybrid = A vehicle that shuts down the engine when coasting, breaking or stopped while continuing to power accessories. There is however, no electric drivetrain like that found on a full hybrid vehicle.



*This list includes public and private refuel sites; therefore, not all of these sites are available to the public.*

**Table 6.5**  
**Number of Alternative Refuel Sites by State and Fuel Type, 2011**

| State             | CNG sites | E85 site | LPG sites | Electric sites | Biodiesel sites | Hydrogen sites | LNG sites | LPG sites | Total |
|-------------------|-----------|----------|-----------|----------------|-----------------|----------------|-----------|-----------|-------|
| Alabama           | 4         | 17       | 128       | 0              | 4               | 0              | 1         | 128       | 154   |
| Alaska            | 2         | 0        | 8         | 0              | 1               | 0              | 0         | 8         | 11    |
| Arizona           | 33        | 31       | 61        | 4              | 14              | 1              | 2         | 61        | 146   |
| Arkansas          | 4         | 14       | 51        | 1              | 6               | 0              | 0         | 51        | 76    |
| California        | 215       | 56       | 228       | 433            | 34              | 22             | 32        | 228       | 1,020 |
| Colorado          | 25        | 84       | 50        | 5              | 14              | 1              | 0         | 50        | 179   |
| Connecticut       | 14        | 0        | 16        | 8              | 3               | 2              | 1         | 16        | 44    |
| Delaware          | 1         | 1        | 3         | 0              | 3               | 0              | 0         | 3         | 8     |
| Dist. of Columbia | 2         | 3        | 0         | 1              | 2               | 1              | 0         | 0         | 9     |
| Florida           | 14        | 42       | 75        | 8              | 15              | 0              | 0         | 75        | 154   |
| Georgia           | 19        | 48       | 47        | 3              | 25              | 0              | 0         | 47        | 142   |
| Hawaii            | 0         | 1        | 3         | 6              | 5               | 1              | 0         | 3         | 16    |
| Idaho             | 7         | 7        | 29        | 5              | 7               | 0              | 0         | 29        | 55    |
| Illinois          | 23        | 209      | 72        | 20             | 6               | 1              | 0         | 72        | 331   |
| Indiana           | 10        | 139      | 47        | 0              | 6               | 0              | 0         | 47        | 202   |
| Iowa              | 0         | 148      | 20        | 6              | 3               | 0              | 0         | 20        | 177   |
| Kansas            | 2         | 38       | 37        | 0              | 6               | 0              | 0         | 37        | 83    |
| Kentucky          | 0         | 24       | 44        | 0              | 2               | 0              | 0         | 44        | 70    |
| Louisiana         | 7         | 5        | 17        | 0              | 1               | 0              | 0         | 17        | 30    |
| Maine             | 1         | 0        | 4         | 0              | 3               | 0              | 0         | 4         | 8     |
| Maryland          | 6         | 19       | 22        | 2              | 9               | 0              | 0         | 22        | 58    |
| Massachusetts     | 22        | 3        | 21        | 3              | 6               | 1              | 0         | 21        | 56    |
| Michigan          | 15        | 107      | 65        | 19             | 13              | 5              | 0         | 65        | 224   |
| Minnesota         | 1         | 364      | 33        | 3              | 0               | 0              | 0         | 33        | 401   |
| Mississippi       | 2         | 4        | 40        | 0              | 4               | 0              | 0         | 40        | 50    |
| Missouri          | 9         | 102      | 66        | 3              | 2               | 1              | 0         | 66        | 183   |
| Montana           | 3         | 2        | 53        | 0              | 6               | 0              | 0         | 53        | 64    |
| Nebraska          | 1         | 60       | 17        | 0              | 3               | 0              | 0         | 17        | 81    |
| Nevada            | 11        | 26       | 43        | 1              | 6               | 2              | 0         | 43        | 89    |
| New Hampshire     | 3         | 0        | 7         | 4              | 11              | 0              | 0         | 7         | 25    |
| New Jersey        | 20        | 5        | 10        | 5              | 4               | 0              | 0         | 10        | 44    |
| New Mexico        | 10        | 11       | 53        | 0              | 6               | 0              | 0         | 53        | 80    |
| New York          | 100       | 75       | 31        | 10             | 16              | 10             | 0         | 31        | 242   |
| North Carolina    | 16        | 20       | 72        | 6              | 142             | 0              | 0         | 72        | 256   |
| North Dakota      | 2         | 58       | 24        | 0              | 3               | 1              | 0         | 24        | 88    |
| Ohio              | 10        | 69       | 67        | 2              | 23              | 1              | 0         | 67        | 172   |
| Oklahoma          | 59        | 14       | 58        | 0              | 5               | 0              | 0         | 58        | 136   |
| Oregon            | 5         | 7        | 30        | 38             | 23              | 0              | 0         | 30        | 103   |
| Pennsylvania      | 24        | 36       | 70        | 1              | 7               | 2              | 0         | 70        | 140   |
| Rhode Island      | 5         | 0        | 5         | 1              | 2               | 0              | 0         | 5         | 13    |
| South Carolina    | 5         | 104      | 26        | 7              | 30              | 2              | 0         | 26        | 174   |
| South Dakota      | 0         | 104      | 18        | 0              | 2               | 0              | 0         | 18        | 124   |
| Tennessee         | 6         | 37       | 76        | 1              | 48              | 0              | 0         | 76        | 168   |
| Texas             | 32        | 54       | 519       | 31             | 16              | 1              | 4         | 519       | 657   |
| Utah              | 71        | 5        | 30        | 2              | 2               | 0              | 0         | 30        | 110   |
| Vermont           | 2         | 0        | 6         | 2              | 2               | 1              | 0         | 6         | 13    |
| Virginia          | 11        | 12       | 37        | 4              | 16              | 1              | 0         | 37        | 81    |
| Washington        | 15        | 15       | 67        | 35             | 28              | 0              | 0         | 67        | 160   |
| West Virginia     | 1         | 3        | 8         | 1              | 1               | 1              | 0         | 8         | 15    |
| Wisconsin         | 16        | 137      | 50        | 6              | 0               | 0              | 0         | 50        | 209   |
| Wyoming           | 7         | 6        | 25        | 0              | 14              | 0              | 0         | 25        | 52    |
| Totals by Fuel:   | 873       | 2,326    | 2,589     | 687            | 610             | 58             | 40        | 2,589     | 7,183 |

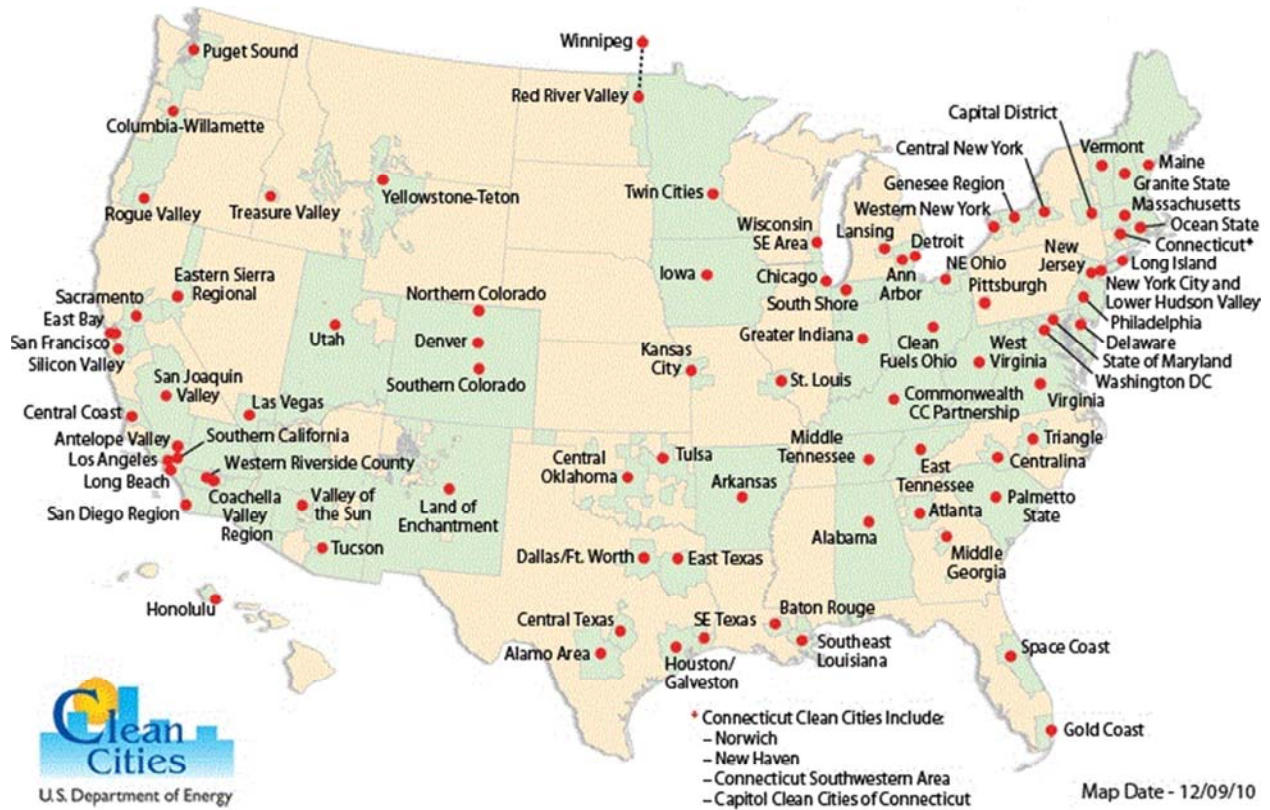
**Source:**

U.S. Department of Energy, Alternative Fuels Data Center Web site,  
[www.eere.energy.gov/afdc/fuels/stations\\_counts.html](http://www.eere.energy.gov/afdc/fuels/stations_counts.html), February 2011.



*Clean Cities is a locally-based government/industry partnership, coordinated by the U.S. Department of Energy to expand the use of alternatives to gasoline and diesel fuel. By combining the decision-making with voluntary action by partners, the "grass-roots" approach of Clean Cities departs from traditional "top-down" Federal programs.*

**Figure 6.1. Clean Cities Coalitions**



**Source:**

U.S. Department of Energy, Alternative Fuel Data Center, February 2011. (Additional resources: [www.eere.energy.gov/cleancities/progs/coalition\\_locations.php](http://www.eere.energy.gov/cleancities/progs/coalition_locations.php))



## Vehicle Technologies Program

**[www.eere.energy.gov/vehiclesandfuels](http://www.eere.energy.gov/vehiclesandfuels)**

**The Vehicle Technologies Program** is administered by the Department of Energy's Office of Energy Efficiency and Renewable Energy. The mission of this program is to develop more energy efficient and environmentally friendly highway transportation technologies that enable America to use less petroleum. The long-term aim is to develop "leap frog" technologies that will provide Americans with greater freedom of mobility and energy security, with lower costs and lower impacts on the environment. For additional information about the Vehicle Technologies Program, visit the Web site listed above.

## Hydrogen Analysis Resource Center

**[hydrogen.pnl.gov/](http://hydrogen.pnl.gov/)**

**The Hydrogen Analysis Resource Center** was developed to provide reliable data and information for hydrogen-related analytical activities. The Center's Web site includes:

- Hydrogen Data Book - contains a wide range of factual information on hydrogen and fuel cells. [hydrogen.pnl.gov/cocoon/morf/hydrogen/article/103](http://hydrogen.pnl.gov/cocoon/morf/hydrogen/article/103).
- Hydrogen Glossary – contains acronyms and terms used commonly in the Hydrogen Analysis Resource Center.
- Related Sites - provides links to other sites with data relevant to hydrogen and fuel cell analysis.
- Guidelines and Assumptions for DOE Hydrogen Program Analysis - contains guidelines for conducting analysis (under development) and assumptions.
- Calculator Tools - provides tools to perform conversions of hydrogen and other calculations relevant to hydrogen and fuel cells.
- Analysis Tools - provides links to models and other tools relevant to hydrogen and fuel cells, such as H2A, GREET, PSAT, VISION, MOVES, and other transportation and energy models.





**Table 6.6**  
**Properties of Conventional and Alternative Fuels**

| Property                        | Gasoline                          | No. 2 diesel                      | Methanol                            | Ethanol                             |
|---------------------------------|-----------------------------------|-----------------------------------|-------------------------------------|-------------------------------------|
| Chemical formula                | C <sub>4</sub> to C <sub>12</sub> | C <sub>8</sub> to C <sub>25</sub> | CH <sub>3</sub> OH                  | C <sub>2</sub> H <sub>5</sub> OH    |
| Physical state                  | Liquid                            | Liquid                            | Liquid                              | Liquid                              |
| Molecular weight                | 100–105                           | ~200                              | 32.04                               | 46.07                               |
| Composition (weight %)          |                                   |                                   |                                     |                                     |
| Carbon                          | 85–88                             | 87                                | 37.5                                | 52.2                                |
| Hydrogen                        | 12–15                             | 13                                | 12.6                                | 13.1                                |
| Oxygen                          | 0                                 | 0                                 | 49.9                                | 34.7                                |
| Main fuel source(s)             | Crude oil                         | Crude oil                         | Natural gas, coal, or woody biomass | Corn, grains, or agricultural waste |
| Specific gravity (60° F/ 60° F) | 0.72–0.78                         | 0.85                              | 0.796                               | 0.794                               |
| Density (lb/gal @ 60° F)        | 6.0–6.5                           | 7.079                             | 6.63                                | 6.61                                |
| Boiling temperature (F°)        | 80–437                            | 356–644                           | 149                                 | 172                                 |
| Freezing point (F°)             | -40                               | -40–30                            | -143.5                              | -173.2                              |
| Autoignition temperature (F°)   | 495                               | ~600                              | 867                                 | 793                                 |
| Reid vapor pressure (psi)       | 8–15                              | <0.2                              | 4.6                                 | 2.3                                 |

| Property                        | Propane                       | CNG                  | Hydrogen  |
|---------------------------------|-------------------------------|----------------------|---|
| Chemical formula                | C <sub>3</sub> H <sub>8</sub> | CH <sub>4</sub>      | H <sub>2</sub>                                  |
| Physical state                  | Compressed gas                | Compressed gas       | Compressed gas or liquid                        |
| Molecular weight                | 44.1                          | 16.04                | 2.02  |
| Composition (weight %)          |                               |                      |   |
| Carbon                          | 82                            | 75                   | 0   |
| Hydrogen                        | 18                            | 25                   | 100   |
| Oxygen                          | n/a                           | n/a                  | 0   |
| Main fuel source                | Underground reserves          | Underground reserves | Natural gas, methanol, and other energy sources |
| Specific gravity (60° F/ 60° F) | 0.508                         | 0.424                | 0.07  |
| Density (lb/gal @ 60° F)        | 4.22                          | 1.07                 | n/a   |
| Boiling temperature (F°)        | -44                           | -263.2 to -126.4     | -423  |
| Freezing point (F°)             | -305.8                        | -296                 | -435  |
| Autoignition temperature (F°)   | 842                           | 900-1,170            | 932   |
| Reid vapor pressure (psi)       | 208                           | 2,400                | n/a   |

**Source:**

Alternative Fuels Data Center, “Properties of Fuel,” [www.eere.energy.gov/afdc/pdfs/fueltable.pdf](http://www.eere.energy.gov/afdc/pdfs/fueltable.pdf) and “Fuel Comparison,” [www.eere.energy.gov/afdc/fuels/properties.html](http://www.eere.energy.gov/afdc/fuels/properties.html), February 2011.

**Note:** n/a = not applicable.





## Chapter 7

### Fleet Vehicles and Characteristics

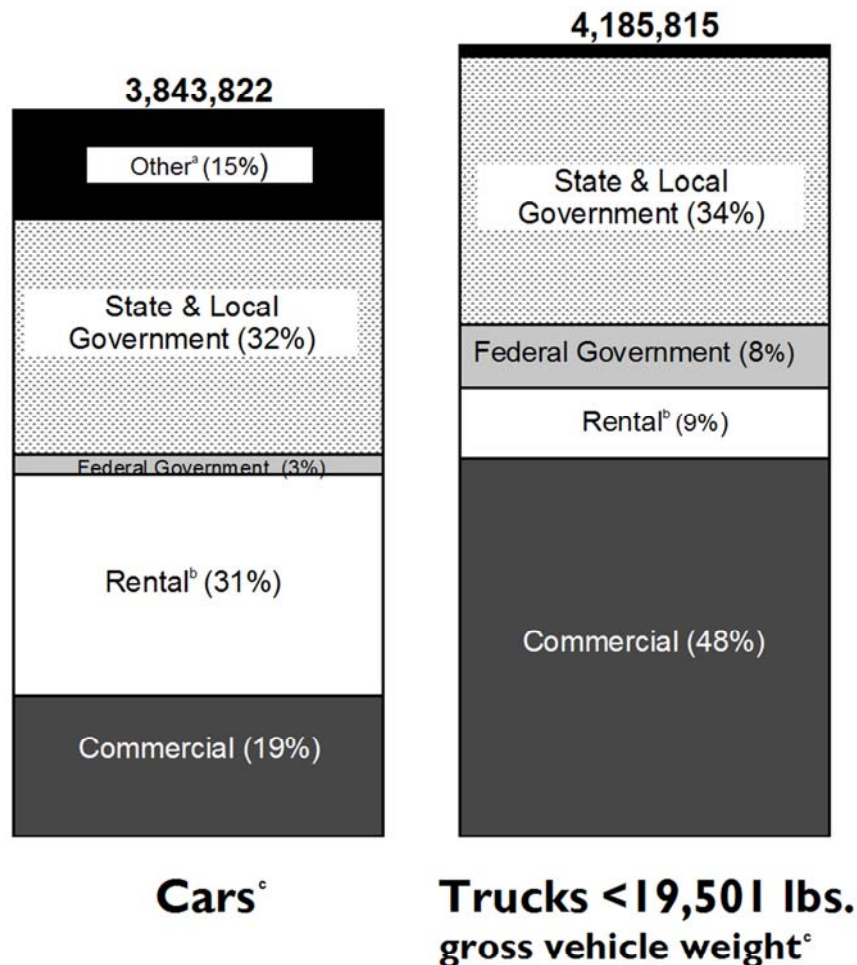
Summary Statistics from Tables in this Chapter

| Source     |   |           |
|------------|---|-----------|
| Figure 7.1 | Fleet cars, 2010  | 3,843,822 |
| Figure 7.1 | Fleet trucks 19,500 lbs. GVW, 2010                              | 4,185,815 |
| Table 7.3  | Average annual miles per business fleet vehicle                 |           |
|            | <i>Light trucks</i>   | 30,240    |
|            | <i>SUVs</i>   | 26,604    |
|            | <i>Intermediate cars</i>  | 25,740    |
| Figure 7.2 | Average annual miles per Federal Government fleet vehicle, 2010 |           |
|            | <i>Sedans &amp; station wagons</i>                              | 11,026    |
|            | <i>SUVs</i>   | 10,171    |
|            | <i>Buses</i>  | 9,912     |
|            | <i>Heavy trucks</i>   | 7,776     |
|            | <i>Medium trucks</i>  | 6,873     |
|            | <i>Light trucks</i>   | 6,144     |
|            | <i>Ambulances</i>   | 5,488     |
| Table 7.4  | Federal government vehicles, FY 2010                            | 659,125   |
|            | <i>Light trucks (&lt;8,500 lbs. GVW)</i>                        | 281,116   |
|            | <i>Cars and other passenger vehicles</i>                        | 246,330   |
|            | <i>Medium trucks (8,500–26,000 lbs. GVW)</i>                    | 89,253    |
|            | <i>Heavy trucks (&gt;26,000 lbs. GVW)</i>                       | 32,760    |
|            | <i>Buses and ambulances</i>                                     | 9,666     |



*Vehicles in fleets of 15 or more are counted as fleet vehicles, as well as vehicles in fleets where five or more vehicles are purchased annually. Historical data on fleets are not available due to definitional changes of what constitutes a fleet.*

**Figure 7.1. Fleet Vehicles in Service as of January 1, 2010**



**Source:**

Bobit Publishing Company, Automotive Fleet Research Department, *Automotive Fleet Factbook 2010*, Redondo Beach, CA, 2011. (Additional resources: [www.fleet-central.com](http://www.fleet-central.com))

<sup>a</sup> Taxi category includes vans.

<sup>b</sup> Rental category includes vans and sports utility vehicles under cars, not trucks.

<sup>c</sup> Fleets of 15 or more in operation or 5 or more fleet vehicles purchased annually.



*Rental companies made the largest light fleet vehicle registrations in 2009 buying over 1.1 million vehicles, most of them cars (64.4%). Only 31.7% of the new commercial fleet registrations were cars.*

**Table 7.1**  
**New Light Fleet Vehicle Registrations by Vehicle Type, Model Year 2009**

|                        | Commercial | Rental    | Government | Total     |
|------------------------|------------|-----------|------------|-----------|
| Cars                   | 31.7%      | 64.4%     | 41.8%      | 53.2%     |
| Pickup trucks          | 28.2%      | 43.6%     | 25.7%      | 12.6%     |
| Vans                   | 20.7%      | 13.9%     | 17.5%      | 16.1%     |
| Sport utility vehicles | 19.4%      | 18.1%     | 15.0%      | 18.1%     |
| Total                  | 456,317    | 1,100,520 | 215,660    | 1,772,497 |

**Source:**

Bobit Publishing Company, *Automotive Fleet Factbook 2010*, [www.automotive-fleet.com/statistics](http://www.automotive-fleet.com/statistics). (Additional resources: [www.fleet-central.com](http://www.fleet-central.com))

**Table 7.2**  
**Average Length of Time Business Fleet Vehicles are in Service, 2009**

| Vehicle type           | Average months<br>in service |
|------------------------|------------------------------|
| Compact cars           | 29                           |
| Intermediate cars      | 26                           |
| Pickup trucks          | 35                           |
| Minivans               | 28                           |
| Sport utility vehicles | 29                           |
| Full-size vans         | 31                           |

**Source:**

Bobit Publishing Company, *Automotive Fleet Factbook 2010*, [www.automotive-fleet.com](http://www.automotive-fleet.com). (Additional resources: [www.fleet-central.com](http://www.fleet-central.com))

**Note:** Based on data collected from four leading Fleet Management companies.

**Table 7.3**  
**Average Annual Vehicle-Miles of Travel  
for Business Fleet Vehicles, 2009**

| Business fleet vehicles | Average annual miles of<br>travel |
|-------------------------|-----------------------------------|
| Compact cars            | 25,572                            |
| Intermediate cars       | 25,740                            |
| Pickup trucks           | 30,240                            |
| Minivans                | 29,952                            |
| Sport utility vehicles  | 26,604                            |
| Full-size vans          | 28,908                            |

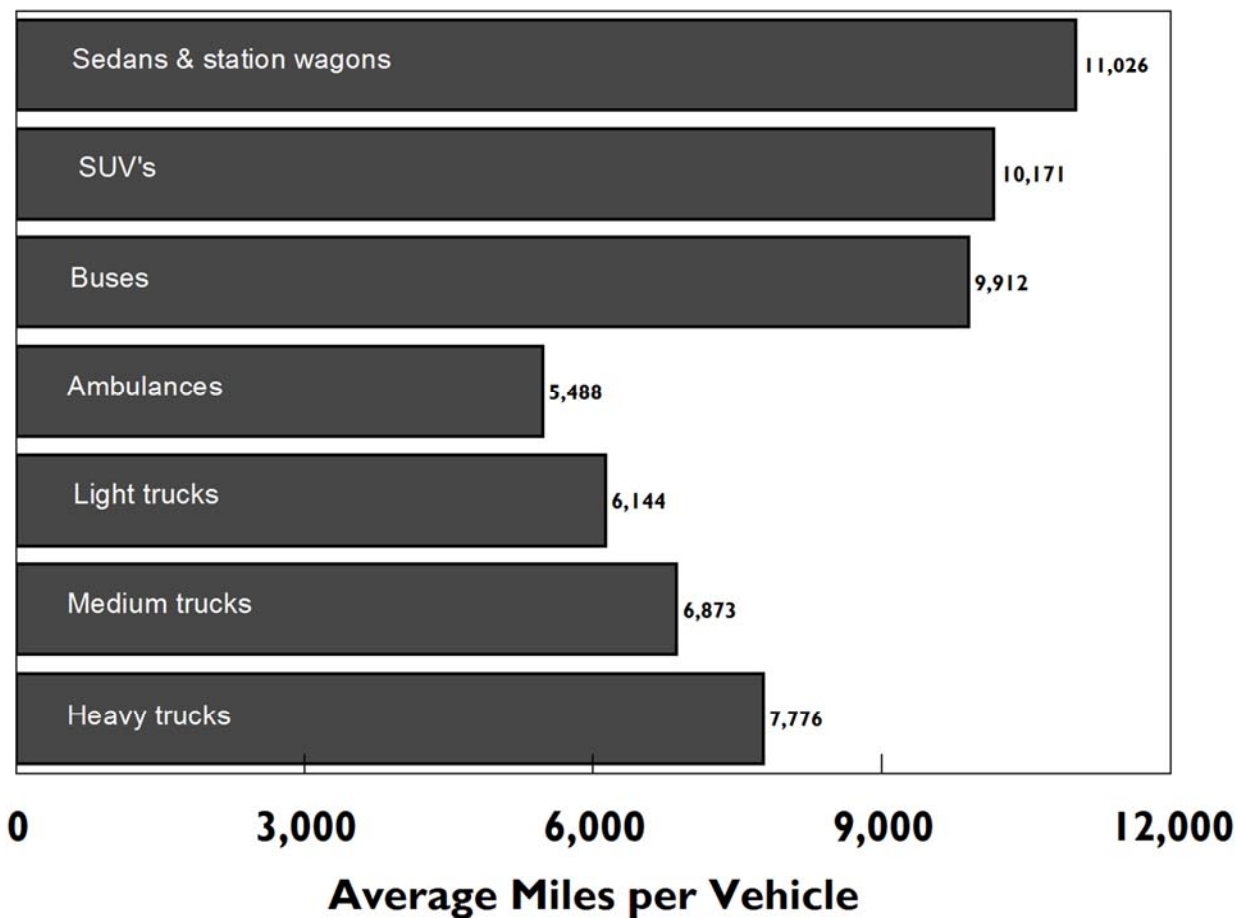
**Source:**

Bobit Publishing Company, *Automotive Fleet Factbook 2010*, [www.automotive-fleet.com](http://www.automotive-fleet.com). (Additional resources: [www.fleet-central.com](http://www.fleet-central.com))



*These data, which apply to domestic Federal fleet vehicles, indicate that sedans and station wagons have the highest average annual miles per vehicle, followed closely by sport utility vehicles and buses.*

**Figure 7.2. Average Miles per Domestic Federal Vehicle by Vehicle Type, 2010**



**Source:**

U.S. General Services Administrations, Federal Vehicle Policy Division, *FY 2010 Federal Fleet Report*, Washington, DC, 2011, Table 4-2. (Additional resources: [www.gsa.gov](http://www.gsa.gov))

**Note:** Light trucks = less than 8,500 pounds GVWR.

Medium trucks = 8,501-23,999 pounds GVWR.

Heavy trucks = 24,000 pounds GVWR or more.



*The Federal Government vehicle inventory includes more light trucks than passenger vehicles.*

**Table 7.4**  
**Federal Government Vehicles, 2001-2010**

| Vehicle Type                           | 2001           | 2002           | 2004           | 2005           | 2006           | 2007           | 2008           | 2009           | 2010           |
|--|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| <b>Passenger Vehicles</b>              |                |                |                |                |                |                |                |                |                |
| Subcompact                             | 5,462          | 4,638          | 4,485          | 2,401          | 2,181          | 1,968          | 3,058          | 5,935          | 6,797          |
| Compact                                | 60,938         | 57,002         | 55,150         | 58,284         | 56,220         | 48,495         | 41,482         | 36,662         | 46,489         |
| Midsize                                | 36,921         | 40,779         | 35,012         | 36,656         | 39,762         | 48,622         | 55,157         | 57,284         | 48,242         |
| Large                                  | 11,107         | 11,265         | 16,235         | 15,966         | 11,783         | 11,907         | 10,679         | 10,230         | 10,063         |
| Limousines                             | 116            | 130            | 227            | 191            | 318            | 217            | 238            | 349            | 412            |
| Light Duty Passenger Vans              | 56,563         | 61,518         | 42,213         | 42,109         | 41,911         | 43,203         | 43,131         | 41,855         | 41,676         |
| Medium Duty Passenger Vans             | 727            | 1,701          | 13,282         | 13,252         | 15,657         | 15,231         | 15,696         | 15,362         | 15,218         |
| Light Duty SUVs                        | 40,842         | 48,343         | 54,992         | 50,445         | 52,393         | 53,837         | 56,329         | 64,793         | 66,316         |
| Medium Duty SUVs                       | 0              | 0              | 7,594          | 6,096          | 7,192          | 7,733          | 10,837         | 7,344          | 11,117         |
| <b>Total Passenger Vehicles</b>        | <b>212,676</b> | <b>225,376</b> | <b>229,190</b> | <b>225,400</b> | <b>227,417</b> | <b>231,213</b> | <b>236,607</b> | <b>239,814</b> | <b>246,330</b> |
| <b>Trucks and Other Vehicles</b>       |                |                |                |                |                |                |                |                |                |
| Light Trucks 4x2                       | 227,937        | 220,205        | 236,123        | 243,477        | 241,847        | 243,720        | 243,143        | 244,022        | 241,011        |
| Light Trucks 4x4                       | 29,975         | 27,108         | 32,121         | 35,417         | 37,019         | 40,115         | 34,962         | 36,713         | 40,105         |
| Medium Trucks                          | 88,993         | 86,949         | 80,474         | 83,747         | 81,721         | 84,414         | 88,509         | 89,052         | 89,253         |
| Heavy Trucks                           | 27,988         | 31,426         | 33,308         | 35,230         | 33,383         | 32,492         | 32,752         | 32,629         | 32,760         |
| Ambulances                             | 1,819          | 1,710          | 1,405          | 1,580          | 1,601          | 1,982          | 1,474          | 1,433          | 1,480          |
| Buses                                  | 6,726          | 7,313          | 7,530          | 7,837          | 7,752          | 8,297          | 8,044          | 8,040          | 8,186          |
| <b>Total Trucks and Other Vehicles</b> | <b>383,438</b> | <b>374,711</b> | <b>390,961</b> | <b>407,288</b> | <b>403,323</b> | <b>411,020</b> | <b>408,884</b> | <b>411,889</b> | <b>412,795</b> |
| <b>GRAND TOTAL ALL VEHICLES</b>        | <b>596,114</b> | <b>600,087</b> | <b>620,151</b> | <b>632,688</b> | <b>630,740</b> | <b>642,233</b> | <b>645,491</b> | <b>651,703</b> | <b>659,125</b> |

**Source:**

U.S. General Services Administration, Federal Supply Service, *FY 2010 Federal Fleet Report*, Washington, DC, 2011, Tables 2-5 and 2-6. (Additional resources: <http://www.gsa.gov>)

**Note:** Light trucks = less than 8,500 pounds GVWR.

Medium trucks = 8,501-23,999 pounds GVWR.

Heavy trucks = 24,000 pounds GVWR or more.



**Table 7.5**  
**Federal Fleet Vehicle Acquisitions**  
**by Fuel Type, FY 2002–2010**

| Fuel Type       | Acquisitions by Year |              |              |        |        |        |        |        |        |
|-----------------|----------------------|--------------|--------------|--------|--------|--------|--------|--------|--------|
|                 | 2002                 | 2003         | 2004         | 2005   | 2006   | 2007   | 2008   | 2009   | 2010   |
| Gasoline        | 44,850               | 42,844       | 43,378       | 41,247 | 37,242 | 32,089 | 30,376 | 31,782 | 26,547 |
| Diesel          | 8,107                | 5,831        | 5,822        | 6,049  | 6,809  | 5,809  | 5,897  | 4,742  | 4,136  |
| Gasoline hybrid | <sup>a</sup>         | <sup>a</sup> | <sup>a</sup> | 222    | 516    | 458    | 531    | 3,959  | 4,853  |
| Diesel hybrid   | <sup>b</sup>         | <sup>b</sup> | <sup>b</sup> | 1      | 0      | 4      | 0      | 4      | 27     |
| CNG             | 1,267                | 1,223        | 809          | 188    | 243    | 129    | 123    | 77     | 60     |
| E-85            | 8,054                | 19,626       | 13,991       | 16,892 | 18,168 | 26,581 | 27,792 | 27,850 | 26,789 |
| Electric        | 7                    | 31           | 88           | 13     | 0      | 7      | 6      | 7      | 1,376  |
| LNG             | 3                    | 0            | 0            | 0      | 0      | 0      | 0      | 0      | 0      |
| LPG             | 59                   | 49           | 26           | 1      | 0      | 4      | 3      | 23     | 2      |
| M-85            | 25                   | 0            | 0            | 0      | 0      | 0      | 0      | 0      | 0      |
| Hydrogen        | 0                    | 0            | 0            | 0      | 0      | 0      | 1      | 1      | 4      |
| Grand Total     | 62,372               | 69,604       | 64,114       | 64,613 | 62,978 | 65,081 | 64,729 | 68,445 | 63,794 |

**Source:**

U.S. General Services Administrations, Federal Vehicle Policy Division, *FY 2010 Federal Fleet Report*, Washington, DC, 2011, Table 5-4. (Additional resources: [www.gsa.gov](http://www.gsa.gov))

**Table 7.6**  
**Fuel Consumed by Federal Government Fleets, FY 2000–2010**  
**(thousand gasoline equivalent gallons)**

|               | FY00    | FY01    | FY02    | FY03    | FY04    | FY05    | FY06    | FY07    | FY08    | FY09    | FY10    |
|---------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Gasoline      | 284,480 | 281,791 | 281,205 | 296,017 | 284,460 | 300,261 | 288,923 | 293,848 | 292,046 | 301,340 | 322,023 |
| Diesel        | 70,181  | 70,761  | 68,487  | 69,109  | 59,199  | 53,363  | 47,489  | 57,700  | 55,617  | 75,540  | 75,149  |
| CNG           | 865     | 2,335   | 1,708   | 575     | 1,159   | 1,245   | 807     | 889     | 731     | 499     | 504     |
| Electricity   | 1       | 35      | 56      | 19      | 3       | 6       | 5       | 5       | 4       | 4       | 36      |
| Biodiesel     | 569     | 1,315   | 2,252   | 3,753   | 6,470   | 8,052   | 8,334   | 9,483   | 6,976   | 7,379   | 8,238   |
| Methanol/M-85 | 14      | 5       | 4       | 3       | 0       | 0       | 0       | 0       | 0       | 0       | 0       |
| LPG           | 34      | 102     | 108     | 104     | 126     | 231     | 105     | 322     | 399     | 208     | 195     |
| Ethanol/E-85  | 347     | 5,900   | 4,673   | 1,592   | 1,784   | 3,060   | 3,206   | 3,853   | 6,293   | 7,922   | 8,200   |
| LNG           | 0       | 52      | 27      | 23      | 91      | 102     | 90      | 95      | 59      | 35      | 0       |
| Other         | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       |
| Total         | 356,491 | 362,296 | 358,520 | 371,195 | 353,292 | 366,320 | 348,959 | 366,195 | 362,125 | 392,927 | 414,346 |

**Source:**

U.S. General Services Administrations, Federal Vehicle Policy Division, *FY 2010 Federal Fleet Report*, Washington, DC, 2011, Table 5-1. (Additional resources: [www.gsa.gov](http://www.gsa.gov))

<sup>a</sup> Combined with gasoline.

<sup>b</sup> Combined with diesel.





*In FY2000, the General Services Administration owned 143,948 vehicles which they leased to other agencies. In FY2010, they owned 1,273 vehicles.*

**Table 7.7**  
**Federal Government Vehicles by Agency, FY 2010**

| Department or Agency                           | Cars           | Buses        | Light trucks   | Medium trucks | Heavy trucks  | Total          |
|--|----------------|--------------|----------------|---------------|---------------|----------------|
| <b>CIVILIAN</b>                                |                |              |                |               |               |                |
| American Battle Monuments Commission           | 23             | 0            | 6              | 11            | 0             | 40             |
| Broadcasting Board of Governors                | 5              | 10           | 120            | 27            | 19            | 181            |
| Consumer Product Safety Commission             | 67             | 0            | 29             | 1             | 0             | 97             |
| Court Services and Offender Supervision Agency | 53             | 0            | 21             | 0             | 0             | 74             |
| Department of Agriculture                      | 5,665          | 73           | 29,489         | 7,924         | 1,959         | 45,110         |
| Department of Commerce                         | 421            | 8            | 1,570          | 365           | 47            | 2,411          |
| Department of Education                        | 63             | 1            | 35             | 0             | 0             | 99             |
| Department of Energy                           | 843            | 182          | 8,032          | 3,859         | 2,110         | 15,026         |
| Department of Health and Human Services        | 1,910          | 7            | 1,976          | 268           | 136           | 4,297          |
| Department of Homeland Security                | 13,534         | 454          | 31,367         | 8,602         | 960           | 54,917         |
| Department of Housing and Urban Development    | 396            | 0            | 79             | 1             | 0             | 476            |
| Department of Justice                          | 19,759         | 225          | 18,969         | 1,241         | 804           | 40,998         |
| Department of Labor                            | 1,149          | 279          | 2,172          | 192           | 32            | 3,824          |
| Department of State                            | 2,559          | 130          | 6,640          | 1,958         | 512           | 11,799         |
| Department of the Interior                     | 3,007          | 484          | 17,569         | 9,236         | 3,608         | 33,904         |
| Department of Transportation                   | 1,616          | 3            | 3,454          | 980           | 110           | 6,163          |
| Department of Treasury                         | 2,717          | 1            | 1,146          | 11            | 10            | 3,885          |
| Department of Veterans Affairs                 | 5,647          | 582          | 7,053          | 777           | 606           | 14,665         |
| Environmental Protection Agency                | 290            | 5            | 686            | 106           | 25            | 1,112          |
| Equal Employment Opportunity Commission        | 66             | 0            | 10             | 0             | 0             | 76             |
| Federal Communications Commission              | 1              | 0            | 115            | 0             | 0             | 116            |
| Federal Housing Finance Agency                 | 5              | 0            | 0              | 0             | 0             | 5              |
| Federal Trade Commission                       | 1              | 0            | 2              | 1             | 0             | 4              |
| General Services Administration                | 701            | 2            | 519            | 44            | 7             | 1,273          |
| Government Printing Office                     | 9              | 0            | 27             | 6             | 5             | 47             |
| Library of Congress                            | 8              | 2            | 7              | 1             | 6             | 24             |
| National Aeronautics and Space Administration  | 579            | 103          | 1,778          | 808           | 380           | 3,648          |
| National Archives & Records Administration     | 14             | 0            | 44             | 11            | 6             | 75             |
| National Gallery of Art                        | 0              | 0            | 6              | 2             | 1             | 9              |
| National Labor Relations Board                 | 36             | 0            | 5              | 0             | 0             | 41             |
| National Science Foundation                    | 30             | 10           | 168            | 126           | 41            | 375            |
| Nuclear Regulatory Commission                  | 11             | 0            | 21             | 0             | 5             | 37             |
| Office of Personnel Management                 | 1,535          | 0            | 121            | 1             | 1             | 1,658          |
| Peace Corps                                    | 34             | 16           | 610            | 0             | 0             | 660            |
| Small Business Administration                  | 203            | 0            | 50             | 4             | 1             | 258            |
| Smithsonian Institution                        | 13             | 9            | 335            | 75            | 30            | 462            |
| Social Security Administration                 | 345            | 7            | 148            | 6             | 29            | 535            |
| Tennessee Valley Authority                     | 566            | 0            | 1,583          | 702           | 45            | 2,896          |
| US Agency for International Development        | 211            | 10           | 746            | 29            | 16            | 1,012          |
| <b>TOTAL CIVILIAN AGENCIES</b>                 | <b>64,092</b>  | <b>2,603</b> | <b>136,708</b> | <b>37,375</b> | <b>11,511</b> | <b>252,289</b> |
| <b>MILITARY</b>                                |                |              |                |               |               |                |
| Corps of Engineers, Civil Works                | 990            | 0            | 5,113          | 1,784         | 631           | 8,518          |
| Defense Agencies                               | 1,684          | 338          | 2,362          | 554           | 419           | 5,357          |
| Department of Air Force                        | 5,079          | 1,639        | 19,990         | 18,047        | 5,971         | 50,726         |
| Department of Army                             | 19,689         | 2,413        | 37,987         | 13,821        | 5,833         | 79,743         |
| Department of Navy                             | 7,889          | 695          | 18,630         | 7,059         | 2,729         | 37,002         |
| United States Marine Corps                     | 3,746          | 494          | 6,021          | 2,063         | 1,295         | 13,619         |
| <b>TOTAL MILITARY AGENCIES</b>                 | <b>39,077</b>  | <b>5,579</b> | <b>90,103</b>  | <b>43,328</b> | <b>16,878</b> | <b>194,965</b> |
| <b>U. S. POSTAL SERVICE</b>                    | <b>8,834</b>   | <b>4</b>     | <b>190,112</b> | <b>8,550</b>  | <b>4,371</b>  | <b>211,871</b> |
| <b>TOTAL ALL FLEETS</b>                        | <b>112,003</b> | <b>8,186</b> | <b>416,923</b> | <b>89,253</b> | <b>32,760</b> | <b>659,125</b> |

**Source:**

U.S. General Services Administration, Federal Supply Service, *FY 2010 Federal Fleet Report*, Washington, DC, 2011, Table 2-1. (Additional resources: [www.gsa.gov](http://www.gsa.gov))

**Note:** Less than 8,500 pounds GVWR (Includes ambulances.)

8,501—23,999 pounds GVWR.

24,000 pounds GVWR or more.





## Chapter 8

### Household Vehicles and Characteristics

Summary Statistics from Tables/Figures in this Chapter

| Source     |  |                      |
|------------|--|----------------------|
| Table 8.2  | Vehicles per capita, 2009                        | 0.808                |
| Table 8.3  | Average household transportation expense, 2009   | 15.6%                |
| Table 8.4  | Share of households owning 3 or more vehicles    |                      |
|            | <i>1960</i>                                      | <i>2.5%</i>          |
|            | <i>1970</i>                                      | <i>5.5%</i>          |
|            | <i>1980</i>                                      | <i>17.5%</i>         |
|            | <i>1990</i>                                      | <i>17.3%</i>         |
|            | <i>2000</i>                                      | <i>18.3%</i>         |
|            | <i>2009</i>                                      | <i>19.9%</i>         |
| Table 8.5  | Vehicles per licensed driver, 2009               | 1.00                 |
| Figure 8.1 | Average occupancy rates by vehicle type, 2009    |                      |
|            | <i>Pickup Truck</i>                              | <i>1.49</i>          |
|            | <i>Car</i>                                       | <i>1.55</i>          |
|            | <i>Sports Utility</i>                            | <i>1.90</i>          |
|            | <i>Van</i>                                       | <i>2.35</i>          |
| Table 8.9  | Average annual miles per household vehicle, 2009 | 11,300               |
| Table 8.15 | Share of workers who car pooled, 2009            | 10.0%                |
| Table 8.20 | Long-distance trips in the United States, 2001   |                      |
|            | <i>Person-trips</i>                              | <i>2,554 million</i> |
|            | <i>Person-miles</i>                              | <i>1,138 billion</i> |



*The number of vehicles in the United States is growing faster than the population. The growth in vehicle-miles has slowed in recent years. See Table 8.2 for vehicles per capita and vehicle-miles per capita.*

**Table 8.1**  
**Population and Vehicle Profile, 1950–2009**

| Year                                    | Resident population <sup>a</sup><br>(thousands) | Total households<br>(thousands) | Number of vehicles in operation<br>(thousands) | Total vehicle-miles<br>(millions) | Number of licensed drivers<br>(thousands) | Number of civilian employed persons<br>(thousands) |
|---|---|---------------------------------|--|-----------------------------------|---|--|
| 1950                                    | 151,868   | 43,554                          | 43,501   | 458,246                           | 62,194                                    | 58,920   |
| 1955                                    | 165,069   | 47,874                          | 56,540   | 605,646                           | 74,686                                    | 62,171   |
| 1960                                    | 179,979   | 52,799                          | 67,906   | 718,762                           | 87,253                                    | 65,778   |
| 1965                                    | 193,526   | 57,436                          | 82,066   | 887,812                           | 98,502                                    | 71,088   |
| 1970                                    | 203,984   | 63,401                          | 98,136   | 1,109,724                         | 111,543                                   | 78,627   |
| 1975                                    | 215,465   | 71,120                          | 120,054  | 1,327,664                         | 129,791                                   | 85,846   |
| 1980                                    | 227,225   | 80,776                          | 139,831  | 1,527,295                         | 145,295                                   | 99,303   |
| 1985                                    | 237,924   | 86,789                          | 157,048  | 1,774,826                         | 156,868                                   | 107,150  |
| 1986                                    | 240,133   | 88,458                          | 162,094  | 1,834,872                         | 159,487                                   | 109,597  |
| 1987                                    | 242,804   | 89,479                          | 167,193  | 1,921,204                         | 161,975                                   | 112,440  |
| 1988                                    | 245,021   | 91,061                          | 171,741  | 2,025,962                         | 162,853                                   | 114,968  |
| 1989                                    | 247,342   | 92,830                          | 175,960  | 2,096,487                         | 165,555                                   | 117,342  |
| 1990                                    | 250,132   | 93,347                          | 179,299  | 2,144,362                         | 167,015                                   | 118,793  |
| 1991                                    | 253,493   | 94,312                          | 181,438  | 2,172,050                         | 168,995                                   | 117,718  |
| 1992                                    | 256,894   | 95,669                          | 181,519  | 2,247,151                         | 173,125                                   | 118,492  |
| 1993                                    | 260,255   | 96,391                          | 186,315  | 2,296,378                         | 173,149                                   | 120,259  |
| 1994                                    | 263,436   | 97,107                          | 188,714  | 2,357,588                         | 175,403                                   | 123,060  |
| 1995                                    | 266,557   | 98,990                          | 193,441  | 2,422,696                         | 176,628                                   | 124,900  |
| 1996                                    | 269,667   | 99,627                          | 198,294  | 2,485,848                         | 179,539                                   | 126,708  |
| 1997                                    | 272,912   | 101,018                         | 201,071  | 2,561,695                         | 182,709                                   | 129,558  |
| 1998                                    | 276,115   | 102,528                         | 205,043  | 2,631,522                         | 184,980                                   | 131,463  |
| 1999                                    | 279,295   | 103,874                         | 209,509  | 2,691,056                         | 187,170                                   | 133,488  |
| 2000                                    | 282,385   | 104,705                         | 213,300  | 2,746,925                         | 190,625                                   | 136,891  |
| 2001                                    | 285,309   | 108,209                         | 216,683  | 2,797,287                         | 191,276                                   | 136,933  |
| 2002                                    | 288,105   | 109,297                         | 221,027  | 2,855,508                         | 194,296                                   | 136,485  |
| 2003                                    | 290,820   | 111,278                         | 225,882  | 2,890,450                         | 196,166                                   | 137,736  |
| 2004                                    | 293,463   | 112,000                         | 231,398  | 2,964,788                         | 198,889                                   | 139,252  |
| 2005                                    | 296,186   | 113,343                         | 237,697  | 2,989,430                         | 200,549                                   | 141,730  |
| 2006                                    | 298,996   | 114,384                         | 244,022  | 3,014,371                         | 202,810                                   | 144,427  |
| 2007                                    | 302,004   | 116,011                         | 248,701  | 3,031,124                         | 205,742                                   | 146,047  |
| 2008                                    | 304,798   | 116,783                         | 250,239  | 2,976,528                         | 208,321                                   | 145,362  |
| 2009                                    | 307,439   | 117,181                         | 248,460  | 2,935,501                         | 209,618                                   | 139,877  |
| <i>Average annual percentage change</i> |   |                                 |  |                                   |   |  |
| 1950–2009                               | 1.2%  | 1.7%                            | 3.0%   | 3.2%                              | 2.1%                                      | 1.5%   |
| 1999–2009                               | 1.0%  | 1.2%                            | 1.7%   | 0.9%                              | 1.1%                                      | 0.5%   |

**Sources:**

Resident population and civilian employed persons - U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States–2011*, Washington, DC, 2011, tables 2, 59, 601, and annual. (Additional resources: [www.census.gov](http://www.census.gov))

Vehicles in operation - The Polk Company. FURTHER REPRODUCTION PROHIBITED. (Additional resources: [www.polk.com](http://www.polk.com))

Licensed drivers and vehicle-miles - U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2009*, Tables DL-1C and VM-1, and annual. (Additional resources: [www.fhwa.dot.gov](http://www.fhwa.dot.gov))

<sup>a</sup> Estimates as of July 1. Includes Armed Forces in the United States.



*Vehicle-miles per capita reached 10,000 miles in 2004 but have declined since then. There were 1.78 vehicles for every employed civilian in the United States in 2009.*

**Table 8.2**  
**Vehicles and Vehicle-Miles per Capita, 1950–2009<sup>a</sup>**

| Year                                    | Vehicles per capita | Vehicle-miles per capita | Vehicles per licensed driver | Vehicles per civilian employed persons |
|---|---------------------|--------------------------|------------------------------|--|
| 1950                                    | 0.286               | 3,017                    | 0.70                         | 0.74                                   |
| 1955                                    | 0.343               | 3,669                    | 0.76                         | 0.91                                   |
| 1960                                    | 0.377               | 3,994                    | 0.78                         | 1.03                                   |
| 1965                                    | 0.424               | 4,588                    | 0.83                         | 1.15                                   |
| 1970                                    | 0.481               | 5,440                    | 0.88                         | 1.25                                   |
| 1975                                    | 0.557               | 6,162                    | 0.92                         | 1.40                                   |
| 1980                                    | 0.615               | 6,722                    | 0.96                         | 1.41                                   |
| 1981                                    | 0.618               | 6,778                    | 0.96                         | 1.41                                   |
| 1982                                    | 0.621               | 6,885                    | 0.96                         | 1.45                                   |
| 1983                                    | 0.629               | 7,069                    | 0.95                         | 1.46                                   |
| 1984                                    | 0.645               | 7,295                    | 0.98                         | 1.45                                   |
| 1985                                    | 0.660               | 7,460                    | 1.00                         | 1.47                                   |
| 1986                                    | 0.675               | 7,641                    | 1.02                         | 1.48                                   |
| 1987                                    | 0.689               | 7,913                    | 1.03                         | 1.49                                   |
| 1988                                    | 0.701               | 8,269                    | 1.05                         | 1.49                                   |
| 1989                                    | 0.711               | 8,476                    | 1.06                         | 1.50                                   |
| 1990                                    | 0.717               | 8,573                    | 1.07                         | 1.51                                   |
| 1991                                    | 0.716               | 8,568                    | 1.07                         | 1.54                                   |
| 1992                                    | 0.707               | 8,747                    | 1.05                         | 1.53                                   |
| 1993                                    | 0.716               | 8,824                    | 1.08                         | 1.55                                   |
| 1994                                    | 0.716               | 8,949                    | 1.08                         | 1.53                                   |
| 1995                                    | 0.726               | 9,089                    | 1.10                         | 1.55                                   |
| 1996                                    | 0.735               | 9,218                    | 1.10                         | 1.56                                   |
| 1997                                    | 0.737               | 9,387                    | 1.10                         | 1.55                                   |
| 1998                                    | 0.743               | 9,531                    | 1.11                         | 1.56                                   |
| 1999                                    | 0.750               | 9,635                    | 1.12                         | 1.57                                   |
| 2000                                    | 0.755               | 9,728                    | 1.12                         | 1.56                                   |
| 2001                                    | 0.759               | 9,804                    | 1.13                         | 1.58                                   |
| 2002                                    | 0.767               | 9,911                    | 1.14                         | 1.62                                   |
| 2003                                    | 0.777               | 9,939                    | 1.15                         | 1.64                                   |
| 2004                                    | 0.789               | 10,103                   | 1.16                         | 1.66                                   |
| 2005                                    | 0.803               | 10,093                   | 1.19                         | 1.68                                   |
| 2006                                    | 0.816               | 10,082                   | 1.20                         | 1.69                                   |
| 2007                                    | 0.824               | 10,037                   | 1.21                         | 1.70                                   |
| 2008                                    | 0.821               | 9,766                    | 1.20                         | 1.72                                   |
| 2009                                    | 0.808               | 9,548                    | 1.19                         | 1.78                                   |
| <i>Average annual percentage change</i> |                     |                          |                              |  |
| 1950–2009                               | 1.8%                | 2.0%                     | 0.9%                         | 1.5%                                   |
| 1999–2009                               | 0.7%                | -0.1%                    | 0.6%                         | 1.3%                                   |

**Sources:**

Resident population and civilian employed persons - U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States–2011*, Washington, DC, 2011, Tables 2 and 601.

(Additional resources: [www.census.gov](http://www.census.gov))

Vehicles in operation - The Polk Company. FURTHER REPRODUCTION PROHIBITED. (Additional resources: [www.polk.com](http://www.polk.com))

Vehicle-miles - U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2009*, Table VM-1 and annual. (Additional resources: [www.fhwa.dot.gov](http://www.fhwa.dot.gov))

<sup>a</sup> Includes all vehicles (light and heavy).



**Table 8.3**  
**Average Annual Expenditures of Households by Income, 2009<sup>a</sup>**

|   | All households | Income before taxes |                 |                   |                   |
|---|----------------|---------------------|-----------------|-------------------|-------------------|
|   |                | Less than \$5,000   | \$5,000–\$9,999 | \$10,000–\$14,999 | \$15,000–\$19,999 |
| Total expenditures                            | \$49,067       | \$22,731            | \$18,032        | \$21,741          | \$23,706          |
| Percentage of total expenditures <sup>b</sup> |                |                     |                 |                   |                   |
| Food <sup>c</sup>                             | 13.0%          | 16.9%               | 16.8%           | 17.1%             | 14.1%             |
| Housing                                       | 34.4%          | 39.3%               | 43.0%           | 41.4%             | 42.2%             |
| Apparel and services                          | 3.5%           | 3.5%                | 4.4%            | 5.0%              | 3.2%              |
| Transportation                                | 15.6%          | 12.5%               | 12.7%           | 12.3%             | 14.7%             |
| <b>Vehicle purchases (net outlay)</b>         | <b>5.4%</b>    | <b>4.1%</b>         | <b>3.6%</b>     | <b>3.1%</b>       | <b>4.0%</b>       |
| <b>Gasoline and motor oil</b>                 | <b>4.0%</b>    | <b>4.1%</b>         | <b>4.2%</b>     | <b>4.1%</b>       | <b>4.7%</b>       |
| <b>Other vehicle expenditures</b>             | <b>5.2%</b>    | <b>3.5%</b>         | <b>4.3%</b>     | <b>4.4%</b>       | <b>5.1%</b>       |
| <b>Public transportation</b>                  | <b>1.0%</b>    | <b>0.8%</b>         | <b>0.6%</b>     | <b>0.7%</b>       | <b>0.9%</b>       |
| Health care                                   | 6.4%           | 5.9%                | 6.1%            | 8.2%              | 8.6%              |
| Entertainment                                 | 5.5%           | 5.5%                | 4.6%            | 4.5%              | 4.6%              |
| Personal Insurance & pensions                 | 11.2%          | 2.2%                | 1.8%            | 2.2%              | 3.5%              |
| Others <sup>d</sup>                           | 9.6%           | 13.1%               | 9.4%            | 8.7%              | 8.5%              |
| Households <sup>e</sup> (thousands)           | 120,847        | 4,749               | 5,203           | 7,726             | 7,669             |
| Percentage of households                      | 100%           | 3.9%                | 4.3%            | 6.4%              | 6.3%              |
| Average number of vehicles in HH              | 2.0            | 0.9                 | 0.8             | 1.0               | 1.2               |

|   | Income before taxes |                   |                   |                   |                   |
|---|---------------------|-------------------|-------------------|-------------------|-------------------|
|   | \$20,000–\$29,999   | \$30,000–\$39,999 | \$40,000–\$49,999 | \$50,000–\$69,999 | \$70,000 and over |
| Total expenditures                            | \$29,397            | \$35,929          | \$39,553          | \$48,900          | \$82,060          |
| Percentage of total expenditures <sup>b</sup> |                     |                   |                   |                   |                   |
| Food <sup>c</sup>                             | 15.0%               | 13.2%             | 13.6%             | 13.1%             | 11.9%             |
| Housing                                       | 38.9%               | 36.1%             | 36.2%             | 34.3%             | 32.2%             |
| Apparel and services                          | 3.7%                | 3.4%              | 3.4%              | 3.3%              | 3.5%              |
| Transportation                                | 14.8%               | 17.6%             | 16.2%             | 17.1%             | 15.4%             |
| <b>Vehicle purchases (net outlay)</b>         | <b>4.1%</b>         | <b>5.9%</b>       | <b>5.3%</b>       | <b>5.6%</b>       | <b>5.8%</b>       |
| <b>Gasoline and motor oil</b>                 | <b>4.9%</b>         | <b>4.7%</b>       | <b>4.9%</b>       | <b>4.6%</b>       | <b>3.5%</b>       |
| <b>Other vehicle expenditures</b>             | <b>5.1%</b>         | <b>6.3%</b>       | <b>5.2%</b>       | <b>6.0%</b>       | <b>4.8%</b>       |
| <b>Public transportation</b>                  | <b>0.7%</b>         | <b>0.7%</b>       | <b>0.7%</b>       | <b>0.8%</b>       | <b>1.2%</b>       |
| Health care                                   | 8.6%                | 7.5%              | 7.4%              | 7.1%              | 5.4%              |
| Entertainment                                 | 5.1%                | 5.5%              | 5.1%              | 5.3%              | 5.8%              |
| Personal Insurance & pensions                 | 5.0%                | 6.6%              | 8.8%              | 10.0%             | 14.9%             |
| Others <sup>d</sup>                           | 8.0%                | 9.3%              | 8.6%              | 8.8%              | 10.1%             |
| Households <sup>e</sup> (thousands)           | 15,022              | 13,053            | 11,444            | 17,799            | 38,181            |
| Percentage of households                      | 12.4%               | 10.8%             | 9.5%              | 14.7%             | 31.6%             |
| Average number of vehicles in HH              | 1.5                 | 1.7               | 1.9               | 2.3               | 2.7               |

**Source:**

U.S. Department of Labor, Bureau of Labor Statistics, Web site: [www.bls.gov/cex/](http://www.bls.gov/cex/), October 2010. (Additional resources: [www.bls.gov](http://www.bls.gov))

<sup>a</sup> Public assistance monies are included in reported income. Data for those reporting income.

<sup>b</sup> Percentages may not sum to totals due to rounding.

<sup>c</sup> Includes alcoholic beverages.

<sup>d</sup> Includes personal care, reading, education, tobacco and smoking supplies, cash contributions, and miscellaneous items.

<sup>e</sup> The term household refers to a “consumer unit,” which is defined differently than households on Table 8.1.



*Household vehicle ownership shows a dramatic increase from 1960 to 1990. In 1960, nearly 79% of households owned less than two vehicles; by 1990, it declined to 45%. Census data prior to 1990 indicated that the majority of households owned one vehicle; in 1990 that changed to two vehicles.*

**Table 8.4**  
**Household Vehicle Ownership, 1960–2009 Census**  
**(percentage)**

|      | No<br>vehicles | One<br>vehicle | Two<br>vehicles | Three or<br>More<br>vehicles |
|------|----------------|----------------|-----------------|------------------------------|
| 1960 | 21.53%         | 56.94%         | 19.00%          | 2.53%                        |
| 1970 | 17.47%         | 47.71%         | 29.32%          | 5.51%                        |
| 1980 | 12.92%         | 35.53%         | 34.02%          | 17.52%                       |
| 1990 | 11.53%         | 33.74%         | 37.35%          | 17.33%                       |
| 2000 | 9.35%          | 33.79%         | 38.55%          | 18.31%                       |
| 2009 | 8.90%          | 33.69%         | 37.56%          | 19.85%                       |

**Source:**

U. S. Department of Transportation, Volpe National Transportation Systems Center, *Journey-to-Work Trends in the United States and its Major Metropolitan Area, 1960–1990*, Cambridge, MA, 1994, p. 2-2.

2000 data - U.S. Bureau of the Census, American Fact Finder, [factfinder.census.gov](http://factfinder.census.gov), Table QT-04, August 2001.  
(Additional resources: [www.census.gov](http://www.census.gov))

2009 data – U.S. Bureau of the Census, American Community Survey, Table DP-4, 2009.



## 2009 National Household Travel Survey Daily Trip Data

The Department of Transportation (DOT) collected data on daily trips in 1969, 1977, 1983, 1990 and 1995 via the Nationwide Personal Transportation Survey (NPTS). For 2001, the DOT combined the collection of long trip and daily trip data into one survey – the 2001 National Travel Household Travel Survey (NHTS). The long trip data were not included in the 2009 NHTS.

The NHTS is the nation's inventory of daily travel. The survey includes demographic characteristics of households, people, vehicles, and detailed information on daily travel for all purposes by all modes. NHTS survey data are collected from a sample of U.S. households and expanded to provide national estimates of trips and miles by travel mode, trip purpose, and a host of household attributes.

The NHTS was designed to continue the NPTS series, but as with all data surveys, caution should be used when comparing statistics from one survey to another due to changes in terminology, survey procedures, and target population. The 2001 and 2009 surveys collected data on trips of children under 5 years of age, while the previous NPTS did not. Improved methodologies first used in the collection of trip information in the 1995 NPTS make it difficult to compare these data with past NPTS survey data. Thus, the 1990 NPTS trip data have been adjusted to make it comparable with the later surveys.

**Table 8.5**  
**Demographic Statistics from the 1969, 1977, 1983, 1990, 1995 NPTS and 2001, 2009 NHTS**

|                                     | 1969 | 1977 | 1983 | 1990 | 1995 | 2001 | 2009 | Percent<br>change<br>1969–2009 |
|-------------------------------------|------|------|------|------|------|------|------|--------------------------------|
| Persons per household               | 3.16 | 2.83 | 2.69 | 2.56 | 2.63 | 2.58 | 2.50 | -21%                           |
| Vehicles per household              | 1.16 | 1.59 | 1.68 | 1.77 | 1.78 | 1.89 | 1.87 | 61%                            |
| Workers per household               | 1.21 | 1.23 | 1.21 | 1.27 | 1.33 | 1.35 | 1.34 | 11%                            |
| Licensed drivers per household      | 1.65 | 1.69 | 1.72 | 1.75 | 1.78 | 1.77 | 1.88 | 14%                            |
| Vehicles per worker                 | 0.96 | 1.29 | 1.39 | 1.40 | 1.34 | 1.39 | 1.40 | 46%                            |
| Vehicles per licensed driver        | 0.70 | 0.94 | 0.98 | 1.01 | 1.00 | 1.06 | 1.00 | 42%                            |
| Average vehicle trip length (miles) | 8.89 | 8.34 | 7.90 | 8.98 | 9.06 | 9.87 | 9.72 | 9%                             |

### Sources:

U.S. Department of Transportation, Federal Highway Administration, *1990 Nationwide Personal Transportation Survey: Summary of Travel Trends*, FHWA-PL-92-027, Washington, DC, March 1992, Table 2. Data for 1995, 2001 and 2009 were generated from the Internet site [nhts.ornl.gov](http://nhts.ornl.gov). (Additional resources: [www.fhwa.dot.gov](http://www.fhwa.dot.gov))

**Note:** Average vehicle trip length for 1990 and 1995 is calculated using only those records with trip mileage information present. The 1969 survey does not include pickups and other light trucks as household vehicles.





*Due to methodology improvements in collecting trip information, the 2001 and 1995 data should be compared only to the 1990 adjusted data. The original 1990 data are comparable to all previous surveys; however, comparisons should always be made with caution because of differing survey methodologies.*

**Table 8.6**  
**Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per Household**  
**1969, 1977, 1983, 1990, 1995 NPTS and 2001, 2009 NHTS**

|   | Journey-to-work <sup>a</sup> | All trips |
|---|------------------------------|-----------|
| <i>Average annual vehicle-miles per household</i> |                              |           |
| 1969  | 4,183                        | 12,423    |
| 1977  | 3,815                        | 12,036    |
| 1983  | 3,538                        | 11,739    |
| 1990 original                                     | 4,853                        | 15,100    |
| 1990 adjusted                                     | 4,853                        | 18,161    |
| 1995  | 6,492                        | 20,895    |
| 2001  | 5,724                        | 21,171    |
| 2009  | 5,513                        | 19,850    |
| <i>Average annual vehicle trips per household</i> |                              |           |
| 1969  | 445                          | 1,396     |
| 1977  | 423                          | 1,442     |
| 1983  | 414                          | 1,486     |
| 1990 original                                     | 448                          | 1,702     |
| 1990 adjusted                                     | 448                          | 2,077     |
| 1995  | 553                          | 2,321     |
| 2001  | 479                          | 2,171     |
| 2009  | 457                          | 2,068     |
| <i>Average vehicle trip length (miles)</i>        |                              |           |
| 1969  | 9.4                          | 8.9       |
| 1977  | 9.0                          | 8.4       |
| 1983  | 8.5                          | 7.9       |
| 1990 original                                     | 11.0                         | 9.0       |
| 1990 adjusted                                     | 11.0                         | 8.9       |
| 1995  | 11.8                         | 9.1       |
| 2001  | 12.2                         | 9.9       |
| 2009  | 12.2                         | 9.7       |

**Sources:**

U.S. Department of Transportation, Federal Highway Administration, *1990 Nationwide Personal Transportation Survey: Summary of Travel Trends*, FHWA-PL-92-027, Washington, DC, March 1992, Table 7. 1990 adjusted data - Oak Ridge National Laboratory, Oak Ridge, TN, August 1998. 1995 NPTS, 2001, 2009 NHTS data were generated from the Internet site [nhts.ornl.gov](http://nhts.ornl.gov). (Additional resources: [www.fhwa.dot.gov](http://www.fhwa.dot.gov), [www.cta.ornl.gov/npts](http://www.cta.ornl.gov/npts))

<sup>a</sup> It is believed that the methodology changes in the 1995 NPTS did not affect journey-to-work trips; therefore, no adjustment is necessary.



*In 2001 and 2009 vehicle-miles traveled (vmt) for a three-person household is around 28,000 miles. The number of drivers in a household makes a big difference in vmt, as does the presence of children in the household. Households with children have more than double the vmt of households without children.*

**Table 8.7**  
**Average Number of Vehicles and Vehicle Travel per Household,**  
**1990 NPTS and 2001 and 2009 NHTS**

| Number of Licensed Drivers    | Average number of vehicles per household |            |            | Average vehicle-miles traveled per household |               |               |
|-------------------------------|--|------------|------------|--|---------------|---------------|
|                               | 1990                                     | 2001       | 2009       | 1990   | 2001          | 2009          |
| 1                             | 1.5                                      | 1.2        | 1.1        | 15,200                                       | 9,700         | 8,800         |
| 2                             | 2.1                                      | 2.2        | 2.2        | 22,900                                       | 25,800        | 23,500        |
| 3                             | 2.9                                      | 3.0        | 3.0        | 29,400                                       | 37,900        | 37,700        |
| 4 or more                     | 3.8                                      | 3.8        | 3.9        | 40,500                                       | 47,200        | 55,200        |
| <b>Household size</b>         |  |            |            |  |               |               |
| 1 person                      | 1.2                                      | 1.0        | 1.0        | 11,400                                       | 7,500         | 7,100         |
| 2 persons                     | 1.9                                      | 2.0        | 2.0        | 19,300                                       | 21,200        | 17,500        |
| 3 persons                     | 2.2                                      | 2.3        | 2.3        | 23,700                                       | 28,400        | 27,900        |
| 4 persons                     | 2.4                                      | 2.4        | 2.4        | 25,300                                       | 28,600        | 33,200        |
| 5 persons                     | 2.4                                      | 2.4        | 2.4        | 24,900                                       | 33,200        | 33,700        |
| 6 or more persons             | 2.7                                      | 2.5        | 2.4        | 29,200                                       | 33,800        | 33,600        |
| <b>Household urban status</b> |  |            |            |  |               |               |
| Urban                         | 1.9                                      | 1.8        | 1.7        | 19,000                                       | 19,300        | 17,600        |
| Rural                         | 2.1                                      | 2.3        | 2.4        | 22,200                                       | 28,400        | 27,700        |
| <b>Household composition</b>  |  |            |            |  |               |               |
| With children                 | 2.2                                      | 2.2        | 2.2        | 24,100                                       | 28,300        | 30,400        |
| Without children              | 1.8                                      | 1.7        | 1.7        | 17,600                                       | 16,700        | 14,400        |
| <b>All households</b>         | <b>1.8</b>                               | <b>1.9</b> | <b>1.9</b> | <b>18,300</b>                                | <b>21,200</b> | <b>19,900</b> |

**Source:**

Generated from the Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Survey Public Use Files, Washington, DC, 2000 and the National Household Travel Survey Internet site: [nhts.ornl.gov](http://nhts.ornl.gov). (Additional resources: [www-cta.ornl.gov/npts](http://www-cta.ornl.gov/npts))



*In 2009, 22% of vehicle trips were traveling to and from work. Another 22% of trips were for shopping. Shopping is done close to home, as the average trip length for shopping was only 6.5 miles.*

**Table 8.8**  
**Trip Statistics by Trip Purpose, 2001 and 2009 NHTS**

| Trip purpose                   | Share of trips |        | Share of vehicle-miles traveled |        | Trip length (miles) |      | Trip length (minutes) |      |
|--------------------------------|----------------|--------|---------------------------------|--------|---------------------|------|-----------------------|------|
|                                | 2001           | 2009   | 2001                            | 2009   | 2001                | 2009 | 2001                  | 2009 |
| To/from work                   | 22.1%          | 22.3%  | 27.0%                           | 28.7%  | 12.1                | 12.2 | 22.3                  | 22.9 |
| Work-related business          | 4.1%           | 3.9%   | 8.4%                            | 7.2%   | 20.3                | 17.2 | 30.9                  | 27.5 |
| Shopping                       | 21.1%          | 22.8%  | 14.5%                           | 15.5%  | 6.7                 | 6.5  | 14.4                  | 14.4 |
| Other family/personal business | 24.7%          | 21.9%  | 18.7%                           | 15.7%  | 7.5                 | 6.8  | 15.2                  | 14.8 |
| School/church                  | 4.9%           | 5.0%   | 3.7%                            | 4.6%   | 7.5                 | 8.8  | 15.8                  | 17.5 |
| Medical/dental                 | 2.2%           | 2.6%   | 2.2%                            | 2.6%   | 9.9                 | 9.9  | 20.7                  | 21.2 |
| Vacation                       | 0.4%           | 0.7%   | 1.8%                            | 2.3%   | 47.4                | 31.4 | 59.6                  | 41.3 |
| Visit friends/relatives        | 6.3%           | 5.7%   | 9.4%                            | 9.4%   | 14.9                | 15.7 | 24.4                  | 24.6 |
| Other social/recreational      | 13.7%          | 14.9%  | 13.2%                           | 13.5%  | 9.6                 | 8.6  | 18.2                  | 17.2 |
| Other                          | 0.5%           | 0.3%   | 1.0%                            | 0.6%   | 18.1                | 19.0 | 31.4                  | 29.7 |
| All                            | 100.0%         | 100.0% | 100.0%                          | 100.0% | 9.9                 | 9.7  | 18.7                  | 18.6 |

**Source:**

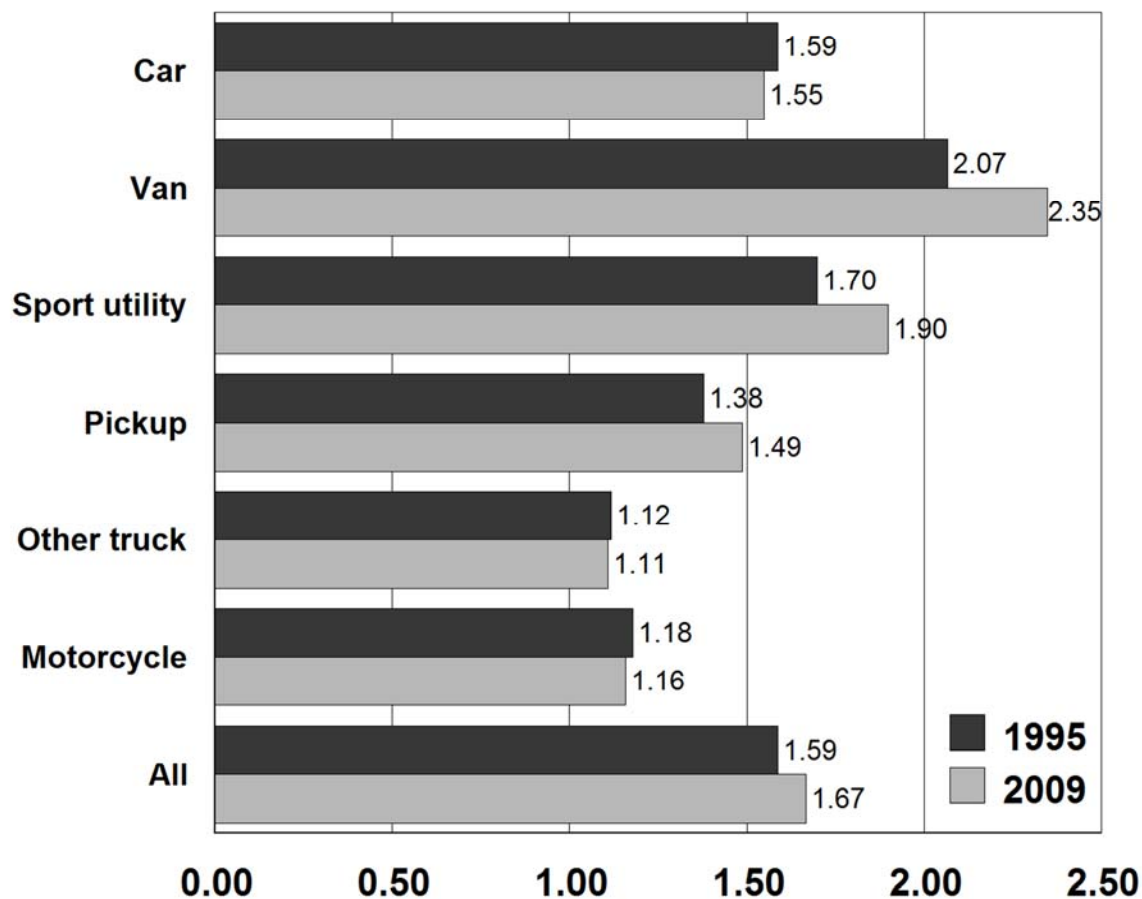
Generated from the National Household Travel Survey Internet site: [nhts.ornl.gov](http://nhts.ornl.gov).

**Note:** The "All" category for average trip length and duration includes records for which trip purpose was not identified.



*While car occupancy stayed nearly constant from 1995 to 2009, most other vehicle types showed increased occupancy. Vans and sport utility vehicles have higher vehicle occupancies than cars.*

**Figure 8.1. Average Vehicle Occupancy by Vehicle Type, 1995 NPTS and 2009 NHTS**



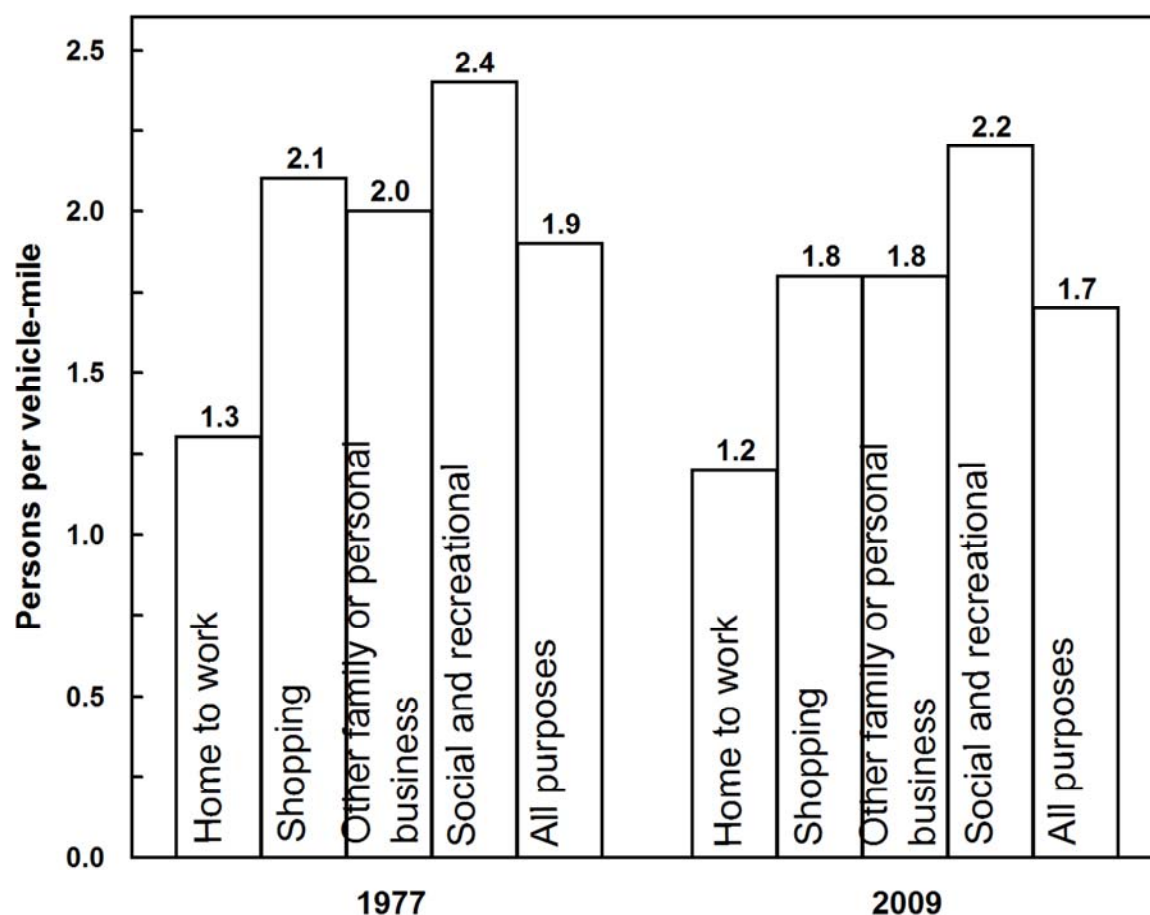
**Sources:**

U.S. Department of Transportation, Federal Highway Administration, 1995 Nationwide Personal Transportation Survey, Washington, DC, 1997, and 2009 National Household Travel Survey, Washington, DC. (Additional resources: [www.fhwa.dot.gov](http://www.fhwa.dot.gov), [nhts.ornl.gov](http://nhts.ornl.gov))



*The average vehicle occupancy, calculated as person-miles per vehicle-mile, is highest for social and recreational purposes. The highest vehicle occupancy levels for all purposes were in 1977. The increase in number of vehicles per household and the decrease in average household size could have contributed to the decline since then.*

**Figure 8.2. Average Vehicle Occupancy by Trip Purpose  
1977 NPTS and 2009 NHTS**



**Sources:**

U.S. Department of Transportation, Federal Highway Administration, *1990 Nationwide Personal Transportation Survey: Summary of Travel Trends*, FHWA-PL-92027, Washington, DC, March 1992, Figure 6. Data from 2009 NHTS were generated from the Internet site [nhts.ornl.gov](http://nhts.ornl.gov), March 2011. (Additional resources: [www.fhwa.dot.gov](http://www.fhwa.dot.gov), [nhts.ornl.gov](http://nhts.ornl.gov))



*The 1990 household survey reports the highest average annual miles per vehicle and the 1983 survey reports the lowest. These data show that younger vehicles are typically driven more miles than older vehicles.*

**Table 8.9**  
**Average Annual Miles per Household Vehicle by Vehicle Age**

| Vehicle age<br>(years)            | 1983<br>self-reported | 1990<br>self-reported | 1995<br>self-reported | 2001<br>self-reported | 2009<br>self-reported |
|-----------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Under 1                           | 8,200                 | 19,600                | 15,900                | 15,500                | 13,200                |
| 1                                 | 15,200                | 16,800                | 16,800                | 14,300                | 14,600                |
| 2                                 | 16,800                | 16,600                | 15,500                | 14,000                | 13,900                |
| 3                                 | 14,500                | 14,700                | 14,400                | 13,100                | 12,700                |
| 4                                 | 13,000                | 13,600                | 14,100                | 12,500                | 12,600                |
| 5                                 | 12,100                | 12,900                | 13,500                | 12,000                | 12,800                |
| 6                                 | 11,300                | 13,200                | 13,200                | 11,800                | 12,100                |
| 7                                 | 10,000                | 12,400                | 12,800                | 11,600                | 11,900                |
| 8                                 | 9,800                 | 12,600                | 12,200                | 10,900                | 11,500                |
| 9                                 | 9,000                 | 11,500                | 12,200                | 10,800                | 11,300                |
| 10 and older                      | 7,300                 | 9,200                 | 8,900                 | 7,400                 | 9,300                 |
| <b>All household<br/>vehicles</b> | <b>10,400</b>         | <b>12,500</b>         | <b>12,200</b>         | <b>11,100</b>         | <b>11,300</b>         |

**Sources:**

Nationwide Personal Transportation Study—1983: D. Klinger and J. Richard Kuzmyak, COMSIS Corporation, *Personal Travel in the United States, Volume 1: 1983–84 Nationwide Personal Travel Study*, prepared for the U.S. Department of Transportation, Washington, DC, August 1986, Table 4-22, p.4-21. 1990: Generated from the 1990 Nationwide Personal Transportation Study Public Use Tape, March 1992. 1995, 2001 and 2009: Generated from the 2009 NHTS datasets, version 2, February 2011. (Additional resources: [nhts.ornl.gov](http://nhts.ornl.gov))

**Note:** Data include all household vehicles, and have been rounded to the nearest hundred.



*Historically, the data from the Nationwide Personal Transportation Survey (NPTS) are based on estimates reported by survey respondents. For the 1995 NPTS and the 2001 National Household Travel Survey (NHTS), odometer data were also collected. The 1995 data indicate that respondents overestimate the number of miles they drive in a year, but the 2001 data do not show that same trend.*

**Table 8.10**  
**Self-Reported vs. Odometer Average Annual Miles, 1995 NPTS and 2001 NHTS**

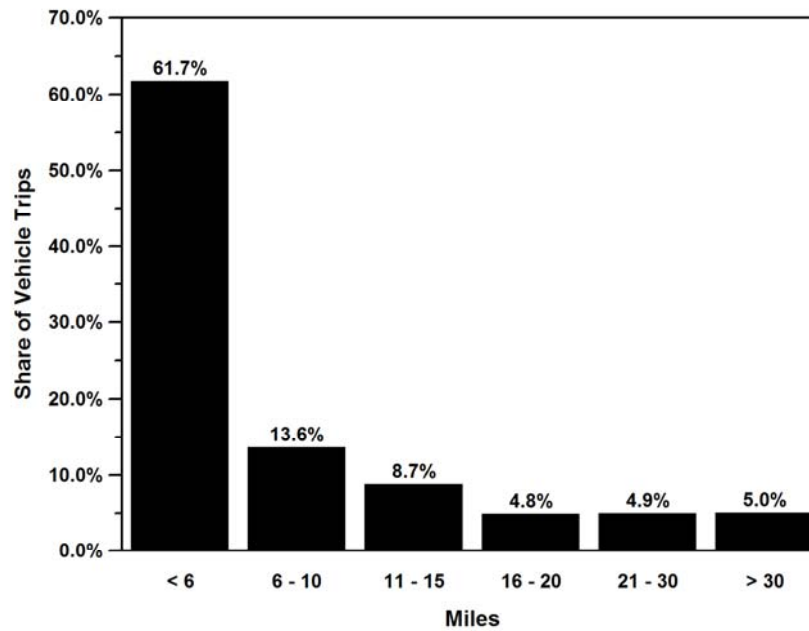
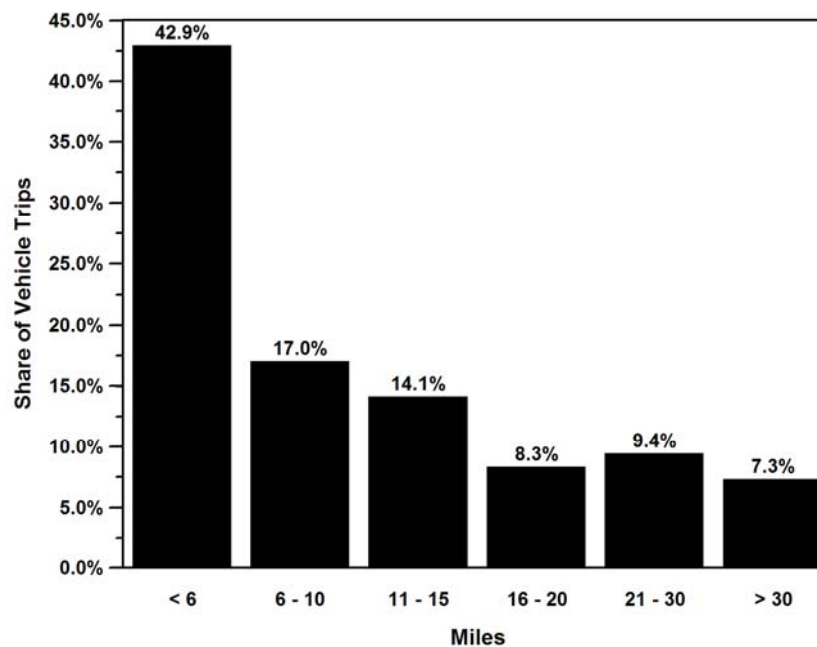
| Vehicle age<br>(years)    | 1995<br>self-reported | 1995<br>odometer | 2001<br>self-reported | 2001<br>odometer |
|---------------------------|-----------------------|------------------|-----------------------|------------------|
| Under 1                   | 15,900                | 15,600           | 15,500                | 14,500           |
| 1                         | 16,800                | 14,500           | 14,300                | 14,200           |
| 2                         | 15,500                | 14,800           | 14,000                | 13,700           |
| 3                         | 14,400                | 13,800           | 13,100                | 14,100           |
| 4                         | 14,100                | 12,900           | 12,500                | 13,400           |
| 5                         | 13,500                | 12,700           | 12,000                | 12,900           |
| 6                         | 13,200                | 12,400           | 11,800                | 12,400           |
| 7                         | 12,800                | 11,600           | 11,600                | 12,100           |
| 8                         | 12,200                | 11,300           | 10,900                | 11,300           |
| 9                         | 12,200                | 11,200           | 10,800                | 10,500           |
| 10 and older              | 8,900                 | 9,000            | 7,400                 | 8,100            |
| All household<br>vehicles | 12,200                | 11,800           | 11,000                | 11,800           |

**Source:**

Generated from the Internet site: [www.cta.ornl.gov/npts](http://www.cta.ornl.gov/npts) and 2001 NHTS public use file.

**Note:** The 2009 NHTS did not collect similar data. Survey methodology on odometer reading data differs from 1995 to 2001 data.



**Figure 8.3. Share of Vehicle Trips by Trip Distance, 2009 NHTS****Source:**National Household Travel Survey, <https://nhts.ornl.gov>.**Figure 8.4. Share of Vehicle Trips to Work by Trip Distance, 2009 NHTS****Source:**National Household Travel Survey, <https://nhts.ornl.gov>.



*Nineteen percent of new vehicles (1 year old and under) travel over 20,000 miles per year. Almost half of the vehicles over 20 years old travel less than 4,000 miles in a year.*

**Table 8.11**  
**Share of Vehicles by Annual Miles of Travel and Vehicle Age, 2009 NHTS**

| Annual vehicle miles of travel | Vehicle age (years) |      |      |      |      |      |      |
|--------------------------------|---------------------|------|------|------|------|------|------|
|                                | 1 and under         | 2    | 3    | 4    | 5    | 6    | 7    |
| < 1,000 miles                  | 2%                  | 3%   | 3%   | 3%   | 3%   | 4%   | 3%   |
| 1 - 2,000 miles                | 2%                  | 3%   | 2%   | 3%   | 3%   | 3%   | 3%   |
| 2 - 4,000 miles                | 5%                  | 6%   | 7%   | 7%   | 6%   | 7%   | 9%   |
| 4 - 6,000 miles                | 7%                  | 10%  | 9%   | 8%   | 8%   | 10%  | 10%  |
| 6 - 8,000 miles                | 10%                 | 10%  | 11%  | 11%  | 10%  | 12%  | 12%  |
| 8 - 10,000 miles               | 11%                 | 11%  | 11%  | 11%  | 11%  | 12%  | 12%  |
| 10 - 12,000 miles              | 9%                  | 11%  | 11%  | 11%  | 12%  | 11%  | 11%  |
| 12 - 15,000 miles              | 16%                 | 15%  | 14%  | 15%  | 15%  | 14%  | 13%  |
| 15 - 20,000 miles              | 18%                 | 15%  | 17%  | 17%  | 16%  | 14%  | 14%  |
| 20 - 30,000 miles              | 13%                 | 11%  | 12%  | 11%  | 11%  | 10%  | 9%   |
| >30,000 miles                  | 6%                  | 5%   | 4%   | 3%   | 4%   | 4%   | 3%   |
| All                            | 100%                | 100% | 100% | 100% | 100% | 100% | 100% |

|                   | Vehicle age (years) |      |      |       |       |         |
|-------------------|---------------------|------|------|-------|-------|---------|
|                   | 8                   | 9    | 10   | 11-15 | 16-20 | Over 20 |
| < 1,000 miles     | 4%                  | 4%   | 4%   | 6%    | 9%    | 19%     |
| 1 - 2,000 miles   | 4%                  | 4%   | 4%   | 5%    | 7%    | 8%      |
| 2 - 4,000 miles   | 9%                  | 9%   | 10%  | 11%   | 16%   | 19%     |
| 4 - 6,000 miles   | 11%                 | 12%  | 12%  | 14%   | 14%   | 14%     |
| 6 - 8,000 miles   | 12%                 | 12%  | 11%  | 14%   | 13%   | 12%     |
| 8 - 10,000 miles  | 13%                 | 11%  | 12%  | 12%   | 10%   | 7%      |
| 10 - 12,000 miles | 11%                 | 11%  | 11%  | 10%   | 8%    | 6%      |
| 12 - 15,000 miles | 13%                 | 13%  | 12%  | 10%   | 8%    | 5%      |
| 15 - 20,000 miles | 12%                 | 13%  | 14%  | 9%    | 7%    | 5%      |
| 20 - 30,000 miles | 9%                  | 8%   | 7%   | 7%    | 4%    | 3%      |
| >30,000 miles     | 3%                  | 3%   | 3%   | 3%    | 2%    | 2%      |
| All               | 100%                | 100% | 100% | 100%  | 100%  | 100%    |

**Source:**

Generated from the Department of Transportation, Federal Highway Administration, 2009 National Household Travel Survey Internet site: [nhts.ornl.gov](http://nhts.ornl.gov). (Additional resources: [nhts.ornl.gov](http://nhts.ornl.gov))



*The average driver makes three trips per day with an average of 9.7 miles for each trip.*

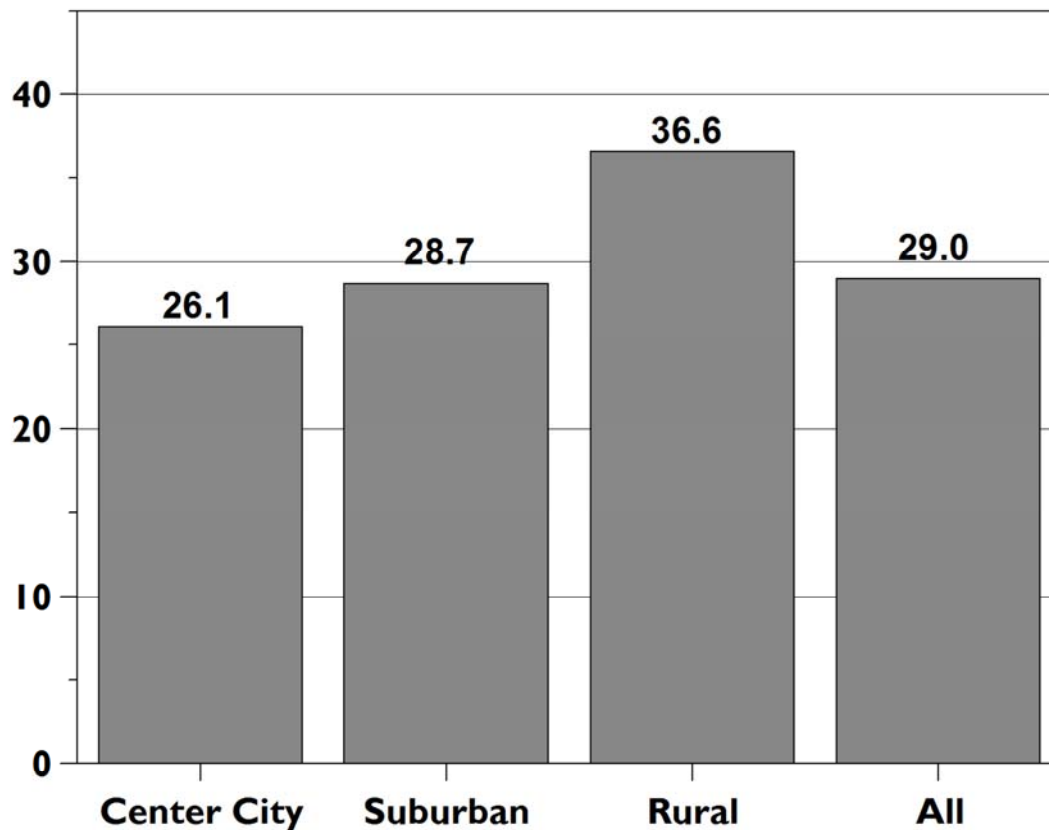
**Table 8.12**  
**Household Vehicle Trips, 2009 NHTS**

|      | Number of daily<br>vehicle trips<br>(per driver) | Average<br>vehicle trip<br>length (miles) | Daily vehicle<br>miles of travel<br>(per driver) |
|------|--|---|--|
| 1990 | 3.3  | 8.9                                       | 28.5   |
| 1995 | 3.6  | 9.1                                       | 32.1   |
| 2001 | 3.4  | 9.9                                       | 32.7   |
| 2009 | 3.0  | 9.7                                       | 29.0   |

**Source:**

National Household Travel Survey, [nhts.ornl.gov](http://nhts.ornl.gov).

**Figure 8.5. Average Daily Miles Driven (per Driver), 2009 NHTS**



**Source:**

National Household Travel Survey, [nhts.ornl.gov](http://nhts.ornl.gov).



**Table 8.13**  
**Daily Vehicle Miles of Travel (per Vehicle) by Number of Vehicles**  
**in the Household, 2009 NHTS**

| Number of household vehicles | Daily miles per vehicle |      |
|------------------------------|-------------------------|------|
|                              | 2001                    | 2009 |
| 1                            | 25.6                    | 29.1 |
| 2                            | 27.5                    | 32.7 |
| 3                            | 24.2                    | 31.3 |
| 4                            | 23.0                    | 30.2 |
| 5                            | 21.1                    | 27.6 |
| More than 5                  | 18.4                    | 27.2 |
| All                          | 25.2                    | 31.1 |

**Source:**

2009 National Household Travel Survey, [nhts.ornl.gov](http://nhts.ornl.gov).

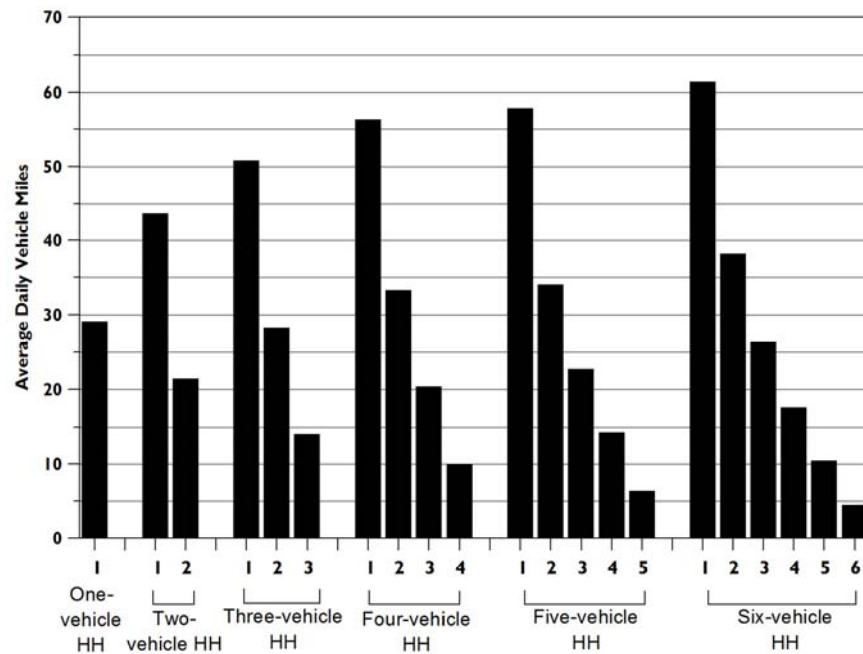
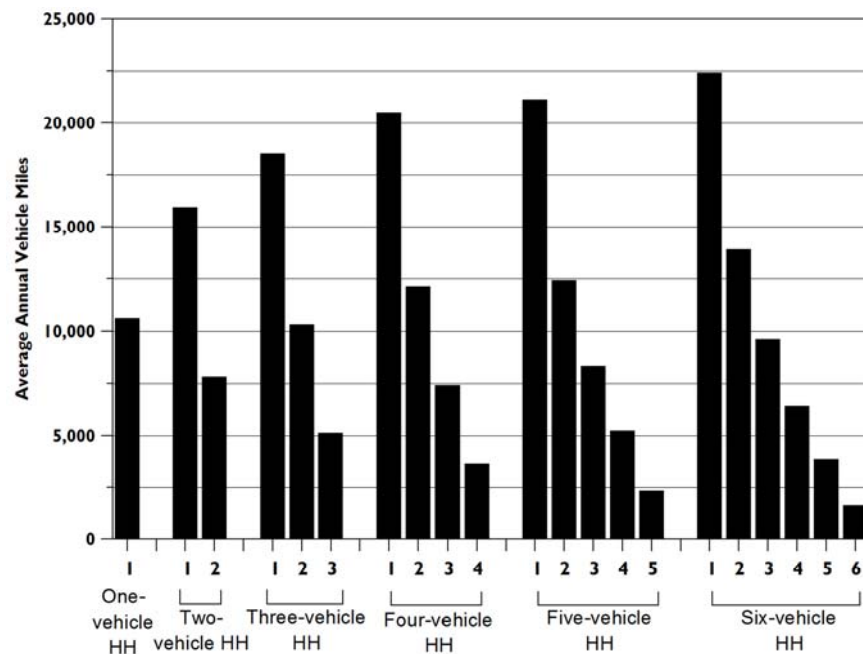
**Table 8.14**  
**Daily and Annual Vehicle Miles of Travel and Average Age for**  
**Each Vehicle in a Household, 2009 NHTS**

| Vehicle number          | Average daily miles | Average annual miles | Average age (years) |
|-------------------------|---------------------|----------------------|---------------------|
| One-vehicle household   |                     |                      |                     |
| 1                       | 29.0                | 10,600               | 9.0                 |
| Two-vehicle household   |                     |                      |                     |
| 1                       | 43.6                | 15,900               | 7.6                 |
| 2                       | 21.4                | 7,800                | 9.0                 |
| Three-vehicle household |                     |                      |                     |
| 1                       | 50.7                | 18,500               | 7.9                 |
| 2                       | 28.2                | 10,300               | 9.1                 |
| 3                       | 14.0                | 5,100                | 11.8                |
| Four-vehicle household  |                     |                      |                     |
| 1                       | 56.2                | 20,500               | 8.5                 |
| 2                       | 33.2                | 12,100               | 8.8                 |
| 3                       | 20.3                | 7,400                | 11.4                |
| 4                       | 9.9                 | 3,600                | 13.2                |
| Five-vehicle household  |                     |                      |                     |
| 1                       | 57.8                | 21,100               | 8.5                 |
| 2                       | 34.0                | 12,400               | 9.4                 |
| 3                       | 22.7                | 8,300                | 12.3                |
| 4                       | 14.2                | 5,200                | 12.7                |
| 5                       | 6.3                 | 2,300                | 16.8                |
| Six-vehicle household   |                     |                      |                     |
| 1                       | 61.4                | 22,400               | 10.2                |
| 2                       | 38.1                | 13,900               | 9.8                 |
| 3                       | 26.3                | 9,600                | 12.2                |
| 4                       | 17.5                | 6,400                | 12.5                |
| 5                       | 10.4                | 3,800                | 14.5                |
| 6                       | 4.4                 | 1,600                | 17.9                |

**Source:**

2009 National Household Travel Survey, [nhts.ornl.gov](http://nhts.ornl.gov).



**Figure 8.6. Daily Vehicle Miles of Travel for Each Vehicle in a Household, 2009 NHTS****Source:**2009 National Household Travel Survey, [nhts.ornl.gov](http://nhts.ornl.gov).**Figure 8.7. Annual Vehicle Miles of Travel for Each Vehicle in a Household, 2009 NHTS****Source:**2009 National Household Travel Survey, [nhts.ornl.gov](http://nhts.ornl.gov).

According to the U.S. Census data, the percentage of workers who car pooled has dropped from 19.7% in 1980 to 10% in 2009. The percent of workers using public transit declined from 6.4% to 5.3% in the ten-year period between 1980 and 1990, but stayed relatively the same from 1990 to 2009 (5.0%). The average travel time increased by 3.5 minutes from 1980 to 2009. The American Community Survey (ACS) now collects journey-to-work data on an annual basis. It shows the average commute time rising to 25.2 minutes in 2009.

**Table 8.15**  
**Means of Transportation to Work, 1980, 1990, 2000, and 2009**

| Means of transportation                     | 1980 Census                   |              | 1990 Census                   |        | 2000 Census                   |        | 2009 ACS                      |        |
|---|-------------------------------|--------------|-------------------------------|--------|-------------------------------|--------|-------------------------------|--------|
|   | Number of workers (thousands) | Share        | Number of workers (thousands) | Share  | Number of workers (thousands) | Share  | Number of workers (thousands) | Share  |
| Private vehicle                             | 81,258                        | 84.1%        | 99,593                        | 86.5%  | 112,736                       | 87.9%  | 119,393                       | 86.1%  |
| <i>Drove alone</i>                          | 62,193                        | 64.4%        | 84,215                        | 73.2%  | 97,102                        | 75.7%  | 105,476                       | 76.1%  |
| <i>Car pooled</i>                           | 19,065                        | 19.7%        | 15,378                        | 13.4%  | 15,635                        | 12.2%  | 13,917                        | 10.0%  |
| Public transportation                       | 6,175                         | 6.4%         | 6,070                         | 5.3%   | 6,068                         | 4.7%   | 6,922                         | 5.0%   |
| <i>Bus or trolley bus<sup>a</sup></i>       | 3,925                         | 4.1%         | 3,445                         | 3.0%   | 3,207                         | 2.5%   | 3,673                         | 2.7%   |
| <i>Streetcar or trolley car<sup>a</sup></i> | <sup>b</sup>                  | <sup>b</sup> | 78                            | 0.1%   | 73                            | 0.1%   | 89                            | 0.1%   |
| <i>Subway or elevated</i>                   | 1,529                         | 1.6%         | 1,755                         | 1.5%   | 1,886                         | 1.5%   | 2,372                         | 1.7%   |
| <i>Railroad</i>                             | 554                           | 0.6%         | 574                           | 0.5%   | 658                           | 0.5%   | 750                           | 0.5%   |
| <i>Ferryboat</i>                            | <sup>b</sup>                  | <sup>b</sup> | 37                            | 0.0%   | 44                            | 0.0%   | 37                            | 0.0%   |
| <i>Taxicab</i>                              | 167                           | 0.2%         | 179                           | 0.2%   | 200                           | 0.2%   | 157                           | 0.1%   |
| Motorcycle                                  | 419                           | 0.4%         | 237                           | 0.2%   | 142                           | 0.1%   | 294                           | 0.2%   |
| Bicycle                                     | 468                           | 0.5%         | 467                           | 0.4%   | 488                           | 0.4%   | 766                           | 0.6%   |
| Walked only                                 | 5,413                         | 5.6%         | 4,489                         | 3.9%   | 3,759                         | 2.9%   | 3,966                         | 2.9%   |
| Other means                                 | 703                           | 0.7%         | 809                           | 0.7%   | 901                           | 0.7%   | 1,176                         | 0.8%   |
| Worked at home                              | 2,180                         | 2.3%         | 3,406                         | 3.0%   | 4,184                         | 3.3%   | 5,918                         | 4.3%   |
| Total workers                               | 96,617                        | 100.0%       | 115,070                       | 100.0% | 128,279                       | 100.0% | 138,592                       | 100.0% |
| Average travel time (minutes)               | 21.7                          |              | 22.4                          |        | 25.5                          |        | 25.2                          |        |

**Sources:**

1980-1990 data - Provided by the Journey-to-Work and Migration Statistics Branch, Population Division, U.S. Bureau of the Census

2000 data - U.S. Bureau of the Census, *Journey to Work: 2000*, Tables 1 and 2, 1990-2000, March 2004 ([www.census.gov/population/www/socdemo/journey.html](http://www.census.gov/population/www/socdemo/journey.html)).

2009 data – U.S. Bureau of the Census, *2009 American Community Survey*, Tables B08301 and S0802. (Additional resources: [www.census.gov](http://www.census.gov))

<sup>a</sup> This category was "Bus or streetcar" in 1980.

<sup>b</sup> Data are not available.



**Table 8.16**  
**Characteristics of U.S. Daily per Vehicle Driving vs. Dwelling Unit Type and Density**

|  | Share of vehicles in density type | Hours per vehicle per day | Average vehicle speed (miles/hour) | Miles per vehicle per day |
|--|-----------------------------------|---------------------------|------------------------------------|---------------------------|
| All classes detached single            | 77.0%                             | 0.92                      | 32.0                               | 29.6                      |
| All classes other                      | 23.0%                             | 0.99                      | 27.7                               | 27.4                      |
| <1,000/sq. mile detached single        | 81.6%                             | 0.91                      | 34.7                               | 31.6                      |
| <1,000/sq. mile all other              | 18.4%                             | 0.91                      | 32.5                               | 29.5                      |
| 1,000-4,000/sq. mile detached single   | 75.5%                             | 0.94                      | 27.5                               | 26.0                      |
| 1,000-4,000/sq. mile all other         | 24.5%                             | 1.03                      | 25.1                               | 25.9                      |
| 4,000-10,000/sq. mile detached single  | 42.5%                             | 0.96                      | 26.1                               | 25.1                      |
| 4,000-10,000/sq. mile all other        | 57.5%                             | 1.15                      | 21.5                               | 24.6                      |
| 10,000-25,000/sq. mile detached single | 17.8%                             | 1.02                      | 18.2                               | 18.5                      |
| 10,000-25,000/sq. mile all other       | 82.2%                             | 1.05                      | 21.3                               | 22.3                      |
| >25,000/sq. mile detached single       | 9.8%                              | 0.72                      | 20.5                               | 14.8                      |
| >25,000/sq. mile all other             | 90.2%                             | 1.23                      | 21.9                               | 26.9                      |

**Source:**

Generated from the 2009 National Household Survey Internet site: [nhts.ornl.gov](http://nhts.ornl.gov).

**Table 8.17**  
**Housing Unit Characteristics, 2009**

| Type of Housing Unit                | Share of occupied housing units | % with garage or carport |
|-------------------------------------|---------------------------------|--------------------------|
| New construction (< = 4 years)      | 4.3%                            | 82.3%                    |
| Manufactured/mobile homes           | 6.1%                            | 38.6%                    |
| Geographic Location (Census Region) |                                 |                          |
| Northeast                           | 18.3%                           | 52.5%                    |
| Midwest                             | 22.7%                           | 73.8%                    |
| South                               | 37.2%                           | 60.2%                    |
| West                                | 21.8%                           | 80.8%                    |
| Tenure                              |                                 |                          |
| Owner                               | 68.4%                           | 79.8%                    |
| Renter                              | 31.6%                           | 37.5%                    |
| All Occupied Units                  | 111,806 units                   | 66.4%                    |

**Source:**

U.S. Bureau of the Census, *2009 American Housing Survey*, Table 2-7. (Additional information: [www.census.gov/prod/2011pubs/h150-09.pdf](http://www.census.gov/prod/2011pubs/h150-09.pdf).)



*The average commute time increased to 25 minutes in 2009. Two thirds of workers travel less than 30 minutes to work. In 1990, 15.9% of workers commuted less than 15 minutes; in 2009, 28.6% enjoyed the short commute.*

**Table 8.18**  
**Workers by Commute Time, 1990, 2000 and 2009**

| Commute time                  | 1990  | 2000  | 2009  |
|-------------------------------|-------|-------|-------|
| Less than 15 minutes          | 15.9% | 30.1% | 28.6% |
| 15–29 minutes                 | 51.6% | 36.3% | 36.5% |
| 30–39 minutes                 | 14.7% | 15.7% | 16.2% |
| 40–59 minutes                 | 9.0%  | 10.7% | 11.0% |
| 60 minutes or more            | 5.9%  | 7.3%  | 7.8%  |
| Average travel time (minutes) | 22.4  | 24.3  | 25.2  |

**Sources:**

1990 - U. S. Department of Transportation, Volpe National Transportation Systems Center, *Journey-to-Work Trends in the United States and its Major Metropolitan Area, 1960–1990*, FHWA-PL-94-012, Cambridge, MA, 1994, p. 2-6.

2000 - U.S. Bureau of the Census, American Fact Finder, [factfinder.census.gov](http://factfinder.census.gov), Tables QT-03 and P048, August 2001. (Additional resources: [www.census.gov](http://www.census.gov))

2009 - U.S. Bureau of the Census, *2009 American Community Survey*, Tables S0802 and B08303.



*Sales of bicycles with wheel sizes of 20 inches and over have grown at an average annual rate of 0.5% from 1981 to 2009. Bicycle sales experienced a large decline in 2009, which brought total sales to 14.9 million—a new low in the 18-year series.*

**Table 8.19**  
**Bicycle Sales, 1981–2009**  
(millions)

|   | Wheel<br>sizes under<br>20 inches | Wheel sizes<br>of 20 inches<br>and over | All<br>wheel<br>sizes |
|---|-----------------------------------|---|-----------------------|
| 1981                                    | <sup>a</sup>                      | 8.9                                     | <sup>a</sup>          |
| 1982                                    | <sup>a</sup>                      | 6.8                                     | <sup>a</sup>          |
| 1983                                    | <sup>a</sup>                      | 9.0                                     | <sup>a</sup>          |
| 1984                                    | <sup>a</sup>                      | 10.1                                    | <sup>a</sup>          |
| 1985                                    | <sup>a</sup>                      | 11.4                                    | <sup>a</sup>          |
| 1986                                    | <sup>a</sup>                      | 12.3                                    | <sup>a</sup>          |
| 1987                                    | <sup>a</sup>                      | 12.6                                    | <sup>a</sup>          |
| 1988                                    | <sup>a</sup>                      | 9.9                                     | <sup>a</sup>          |
| 1989                                    | <sup>a</sup>                      | 10.7                                    | <sup>a</sup>          |
| 1990                                    | <sup>a</sup>                      | 10.8                                    | <sup>a</sup>          |
| 1991                                    | <sup>a</sup>                      | 11.6                                    | <sup>a</sup>          |
| 1992                                    | 3.7                               | 11.6                                    | 15.3                  |
| 1993                                    | 3.8                               | 13.0                                    | 16.8                  |
| 1994                                    | 4.2                               | 12.5                                    | 16.7                  |
| 1995                                    | 4.1                               | 12.0                                    | 16.1                  |
| 1996                                    | 4.5                               | 10.9                                    | 15.4                  |
| 1997                                    | 4.2                               | 11.0                                    | 15.2                  |
| 1998                                    | 4.7                               | 11.1                                    | 15.8                  |
| 1999                                    | 5.9                               | 11.6                                    | 17.5                  |
| 2000                                    | 9.0                               | 11.9                                    | 20.9                  |
| 2001                                    | 5.4                               | 11.3                                    | 16.7                  |
| 2002                                    | 5.9                               | 13.6                                    | 19.5                  |
| 2003                                    | 5.6                               | 12.9                                    | 18.5                  |
| 2004                                    | 5.3                               | 13.0                                    | 18.3                  |
| 2005                                    | 5.8                               | 14.0                                    | 19.8                  |
| 2006                                    | 5.5                               | 12.7                                    | 18.2                  |
| 2007                                    | 5.4                               | 12.8                                    | 18.2                  |
| 2008                                    | 5.1                               | 13.4                                    | 18.5                  |
| 2009                                    | 4.7                               | 10.2                                    | 14.9                  |
| <i>Average annual percentage change</i> |                                   |   |                       |
| 1981–2009                               | <sup>a</sup>                      | 0.5%                                    | <sup>a</sup>          |
| 1999–2009                               | -2.2%                             | -1.3%                                   | -1.6%                 |

**Source:**

1981–1996: Bicycle Manufacturers Association. 1997–on: National Bicycle Dealers Association. (Additional resources: [www.nbda.com](http://www.nbda.com))

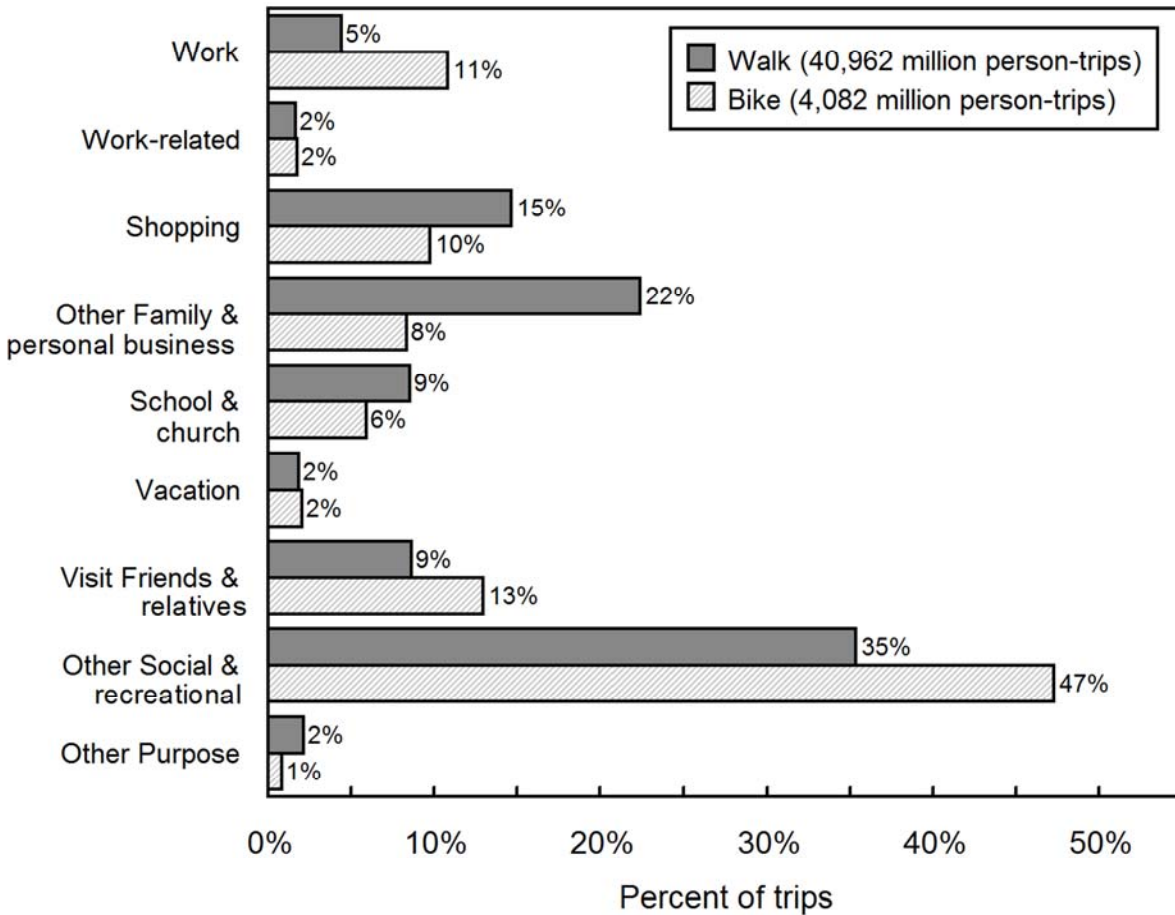
<sup>a</sup> Data are not available.





*In 2009, 4.5% of walk trips and 10.9% of bike trips were to/from work. Forty-seven percent of all bike trips were for social/recreational purposes. Nearly 15% of walk trips were shopping trips.*

**Figure 8.8. Walk and Bike Trips by Trip Purpose, 2009 NHTS**



**Source:**

U.S. Department of Transportation, Federal Highway Administration, 2009 National Household Travel Survey Web site: [nhts.ornl.gov](http://nhts.ornl.gov).



*In 2009 only data on daily trips were collected in the NHTS. The 2001 data are still the latest available on long-distance trips.*

### **Long Distance Trips – 2001 National Household Travel Survey**

The 2001 National Household Travel Survey (NHTS) collected data on long-distance trips as well as everyday travel. The everyday travel data is a continuation of the Nationwide Personal Transportation Survey (NPTS), while the long-distance travel data is a continuation of the American Travel Survey (ATS) which was collected in 1977 and 1985. The survey collected trip-related data such as mode of transportation, duration, distance and purpose of trip. It also gathered demographic, geographic, and economic data for analysis purposes.

A long-distance trip is defined as a trip of 50 miles or more, one-way. Long-trip data from the 2001 NHTS were released in the summer of 2004. For additional information about the 2001 NHTS data, contact the Bureau of Transportation Statistics at 202-366-3282 or visit the following Internet site: [www.bts.gov/programs/national\\_household\\_travel\\_survey](http://www.bts.gov/programs/national_household_travel_survey).



**Table 8.20**  
**Long-Distance Trip<sup>a</sup> Characteristics, 2001 NHTS**

| Trip characteristic                   | Person trips |           | Person miles  |           |
|---------------------------------------|--------------|-----------|---------------|-----------|
|                                       | (thousands)  | (percent) | (thousands)   | (percent) |
| Total                                 | 2,554,068    | 100.0     | 1,138,322,697 | 100.0     |
| Principal means of transportation:    |              |           |               |           |
| Personal use vehicles                 | 2,310,376    | 90.5      | 735,882,255   | 64.7      |
| Airplane                              | 165,039      | 6.5       | 367,888,741   | 32.3      |
| Commercial airplane                   | 158,880      | 6.2       | 361,717,015   | 31.8      |
| Bus <sup>b</sup>                      | 52,962       | 2.1       | 23,747,433    | 2.1       |
| Intercity bus                         | 3,456        | 0.1       | 1,765,696     | 0.2       |
| Charter, tour, or school bus          | 45,952       | 1.8       | 21,019,942    | 1.9       |
| Train                                 | 20,672       | 0.8       | 9,266,373     | 0.8       |
| Round trip distance:                  |              |           |               |           |
| 100 to 300 miles                      | 1,688,358    | 66.1      | 284,586,370   | 25.0      |
| 300 to 499 miles                      | 373,550      | 14.6      | 143,571,597   | 12.6      |
| 500 to 999 miles                      | 261,802      | 10.3      | 180,669,482   | 15.9      |
| 1,000 to 1,999 miles                  | 125,665      | 4.9       | 178,629,838   | 15.7      |
| 2,000 miles or more                   | 104,694      | 4.1       | 350,865,409   | 30.8      |
| Mean (miles)                          | 446          | c         | c             | c         |
| Median (miles)                        | 206          | c         | c             | c         |
| Calendar quarter:                     |              |           |               |           |
| 1st quarter                           | 566,502      | 22.2      | 246,556,190   | 21.7      |
| 2nd quarter                           | 653,310      | 25.6      | 298,154,812   | 26.2      |
| 3rd quarter                           | 734,878      | 28.8      | 341,021,290   | 30.0      |
| 4th quarter                           | 599,378      | 23.5      | 252,590,405   | 22.2      |
| Main purpose of trip:                 |              |           |               |           |
| Commuting                             | 329,395      | 12.9      | 65,877,968    | 5.8       |
| Other business                        | 405,866      | 15.9      | 242,353,212   | 21.3      |
| Personal/leisure                      | 1,406,411    | 55.1      | 667,471,358   | 58.7      |
| Personal business                     | 322,645      | 12.6      | 130,020,982   | 11.4      |
| Other                                 | 88,230       | 3.5       | 32,031,679    | 2.8       |
| Nights away from home:                |              |           |               |           |
| None                                  | 1,454,847    | 57.0      | 304,469,524   | 26.8      |
| 1 to 3 nights                         | 808,281      | 31.7      | 414,219,147   | 36.4      |
| 4 to 7 nights                         | 214,464      | 8.4       | 269,265,597   | 23.7      |
| 8 or more nights                      | 76,475       | 3.0       | 150,368,429   | 13.2      |
| Destination:                          |              |           |               |           |
| Within Census division                | 2,077,810    | 81.4      | 549,651,116   | 48.3      |
| Across Census division, within Census | 196,890      | 7.7       | 134,930,113   | 11.9      |
| Across Census region                  | 279,367      | 10.9      | 453,741,468   | 39.9      |

**Source:**

U.S. Bureau of Transportation Statistics and the U.S. Federal Highway Administration, 2001 National Household Transportation Survey.

**Note:** Long-distance trips were not included in the 2009 NHTS.

<sup>a</sup> A long-distance trip is defined as a trip of 50 miles or more, one-way.

<sup>b</sup> Includes other types of buses.

<sup>c</sup> Not applicable.





## Chapter 9

### Nonhighway Modes

Summary Statistics from Tables in this Chapter

| Source            |   |                 |
|-------------------|---|-----------------|
|                   | Passenger-miles                                     | (millions)      |
| <i>Table 9.2</i>  | <i>Domestic and international air carrier, 2009</i> | 779,982         |
| <i>Table 9.10</i> | <i>Amtrak, 2009</i>                                 | 5,914           |
| <i>Table 9.11</i> | <i>Commuter rail, 2009</i>                          | 11,232          |
| <i>Table 9.12</i> | <i>Transit rail, 2009</i>                           | 19,004          |
|                   | Freight ton-miles                                   | (millions)      |
| <i>Table 9.5</i>  | <i>Domestic waterborne commerce, 2009</i>           | 477,000         |
| <i>Table 9.8</i>  | <i>Class I railroad, 2009</i>                       | 1,532,214       |
|                   | Passenger energy use                                | (trillion Btus) |
| <i>Table 9.2</i>  | <i>Domestic and international air carrier, 2009</i> | 2,303.2         |
| <i>Table 9.3</i>  | <i>General aviation, 2009</i>                       | 220.6           |
| <i>Table 9.6</i>  | <i>Recreational boats, 2009</i>                     | 245.6           |
| <i>Table 9.10</i> | <i>Amtrak, 2009</i>                                 | 14.4            |
| <i>Table 9.11</i> | <i>Commuter rail, 2009</i>                          | 31.6            |
| <i>Table 9.12</i> | <i>Transit rail, 2009</i>                           | 47.8            |
|                   | Freight energy use                                  | (trillion Btus) |
| <i>Table 9.8</i>  | <i>Class I railroad, 2009</i>                       | 446.6           |



*Nonhighway transportation modes accounted for 17.4% of total transportation energy use in 2009.*

**Table 9.1**  
**Nonhighway Energy Use Shares, 1970–2009**

| Year | Share of transportation energy use |       |          |      |                     | Transportation<br>total (trillion Btu) |
|------|------------------------------------|-------|----------|------|---------------------|--|
|      | Air                                | Water | Pipeline | Rail | Nonhighway<br>total |  |
| 1970 | 8.5%                               | 5.4%  | 6.4%     | 3.6% | 24.0%               | 15,395                                 |
| 1971 | 8.1%                               | 4.8%  | 6.3%     | 3.5% | 22.8%               | 16,015                                 |
| 1972 | 7.7%                               | 4.6%  | 6.1%     | 3.4% | 21.9%               | 17,036                                 |
| 1973 | 7.7%                               | 5.0%  | 5.6%     | 3.4% | 21.7%               | 17,874                                 |
| 1974 | 7.3%                               | 5.1%  | 5.4%     | 3.6% | 21.5%               | 17,174                                 |
| 1975 | 7.3%                               | 5.3%  | 4.8%     | 3.2% | 20.7%               | 17,424                                 |
| 1976 | 7.2%                               | 5.9%  | 4.3%     | 3.1% | 20.6%               | 18,491                                 |
| 1977 | 7.1%                               | 6.2%  | 4.1%     | 3.1% | 20.4%               | 19,126                                 |
| 1978 | 7.1%                               | 6.9%  | 3.9%     | 2.9% | 20.8%               | 20,097                                 |
| 1979 | 7.6%                               | 5.8%  | 4.4%     | 3.1% | 20.9%               | 19,652                                 |
| 1980 | 7.6%                               | 7.4%  | 4.7%     | 3.1% | 22.8%               | 18,940                                 |
| 1981 | 7.8%                               | 6.8%  | 4.8%     | 3.0% | 22.4%               | 18,741                                 |
| 1982 | 7.9%                               | 5.8%  | 4.7%     | 2.6% | 21.1%               | 18,237                                 |
| 1983 | 7.8%                               | 5.3%  | 4.0%     | 2.6% | 19.8%               | 18,368                                 |
| 1984 | 8.5%                               | 5.1%  | 4.1%     | 2.8% | 20.5%               | 18,962                                 |
| 1985 | 8.7%                               | 4.5%  | 3.9%     | 2.6% | 19.8%               | 19,205                                 |
| 1986 | 9.0%                               | 6.5%  | 3.6%     | 2.4% | 21.5%               | 20,276                                 |
| 1987 | 9.1%                               | 6.6%  | 3.7%     | 2.4% | 21.9%               | 20,771                                 |
| 1988 | 9.3%                               | 6.6%  | 4.1%     | 2.4% | 22.4%               | 21,327                                 |
| 1989 | 9.1%                               | 7.0%  | 4.1%     | 2.4% | 22.6%               | 21,685                                 |
| 1990 | 9.6%                               | 6.7%  | 4.3%     | 2.3% | 22.9%               | 21,613                                 |
| 1991 | 9.1%                               | 7.2%  | 4.1%     | 2.3% | 22.6%               | 21,205                                 |
| 1992 | 9.0%                               | 7.3%  | 3.9%     | 2.2% | 22.4%               | 21,866                                 |
| 1993 | 8.9%                               | 6.4%  | 4.0%     | 2.3% | 21.6%               | 22,322                                 |
| 1994 | 9.0%                               | 6.1%  | 4.1%     | 2.3% | 21.6%               | 22,926                                 |
| 1995 | 9.1%                               | 6.3%  | 4.1%     | 2.4% | 21.9%               | 23,465                                 |
| 1996 | 9.2%                               | 5.9%  | 4.1%     | 2.4% | 21.6%               | 23,973                                 |
| 1997 | 9.5%                               | 5.1%  | 4.2%     | 2.4% | 21.2%               | 24,327                                 |
| 1998 | 9.6%                               | 5.0%  | 3.6%     | 2.3% | 20.5%               | 24,757                                 |
| 1999 | 9.5%                               | 5.3%  | 3.5%     | 2.3% | 20.6%               | 25,948                                 |
| 2000 | 9.7%                               | 5.5%  | 3.4%     | 2.3% | 21.0%               | 26,268                                 |
| 2001 | 9.3%                               | 4.6%  | 3.4%     | 2.3% | 19.6%               | 25,958                                 |
| 2002 | 8.3%                               | 4.7%  | 3.5%     | 2.3% | 18.8%               | 26,521                                 |
| 2003 | 8.3%                               | 4.0%  | 3.2%     | 2.3% | 17.8%               | 26,672                                 |
| 2004 | 8.7%                               | 4.8%  | 3.0%     | 2.4% | 18.9%               | 27,065                                 |
| 2005 | 9.0%                               | 5.0%  | 3.1%     | 2.4% | 19.4%               | 27,526                                 |
| 2006 | 9.0%                               | 5.2%  | 3.0%     | 2.4% | 19.7%               | 27,759                                 |
| 2007 | 8.6%                               | 5.3%  | 3.0%     | 2.2% | 19.1%               | 29,334                                 |
| 2008 | 8.4%                               | 4.8%  | 3.2%     | 2.2% | 18.5%               | 28,611                                 |
| 2009 | 7.7%                               | 4.7%  | 3.1%     | 2.0% | 17.4%               | 27,692                                 |

**Source:**

See Appendix A for Nonhighway Energy Use.



*These data include ALL international and domestic certificated route air carrier statistics; therefore, the data are different than those in Chapter 2. Revenue aircraft-miles, passenger-miles, and seat-miles continued to decline in 2009. Passenger load factor was 80% in 2009.*

**Table 9.2**  
**Summary Statistics for U.S. Domestic and International**  
**Certificated Route Air Carriers (Combined Totals), 1970–2009<sup>a</sup>**

| Year                                    | Revenue aircraft-miles (millions) | Revenue passenger-miles (millions) | Available seat-miles (millions) | Available seats per aircraft <sup>b</sup> | Passenger load factor (percentage) <sup>c</sup> | Revenue cargo ton-miles (millions) | Energy use (trillion Btu) <sup>d</sup> |
|---|-----------------------------------|------------------------------------|---------------------------------|---|---|------------------------------------|--|
| 1970                                    | 2,542                             | 148,137                            | 264,904                         | 104                                       | 55.9%   | 3,755                              | 1,363.4                                |
| 1975                                    | 2,241                             | 173,324                            | 315,823                         | 141                                       | 54.9%   | 5,062                              | 1,283.4                                |
| 1980                                    | 2,924                             | 267,722                            | 448,479                         | 153                                       | 59.7%   | 7,885                              | 1,386.0                                |
| 1985                                    | 3,462                             | 351,073                            | 565,677                         | 163                                       | 62.1%   | 9,048                              | 1,701.4                                |
| 1986                                    | 3,873                             | 378,923                            | 623,075                         | 161                                       | 60.8%   | 10,987                             | 1,847.1                                |
| 1987                                    | 4,182                             | 417,808                            | 670,825                         | 160                                       | 62.3%   | 13,137                             | 1,954.9                                |
| 1988                                    | 4,354                             | 437,649                            | 696,337                         | 160                                       | 62.9%   | 14,632                             | 2,049.4                                |
| 1989                                    | 4,442                             | 447,480                            | 703,888                         | 158                                       | 63.6%   | 16,347                             | 2,087.4                                |
| 1990                                    | 4,724                             | 472,236                            | 753,211                         | 159                                       | 62.7%   | 16,403                             | 2,213.0                                |
| 1991                                    | 4,661                             | 463,296                            | 738,030                         | 158                                       | 62.8%   | 16,149                             | 2,085.2                                |
| 1992                                    | 4,899                             | 493,715                            | 772,869                         | 158                                       | 63.9%   | 17,306                             | 2,144.2                                |
| 1993                                    | 5,118                             | 505,996                            | 793,959                         | 155                                       | 63.7%   | 19,083                             | 2,169.7                                |
| 1994                                    | 5,360                             | 537,518                            | 809,259                         | 151                                       | 66.4%   | 21,773                             | 2,266.2                                |
| 1995                                    | 5,627                             | 558,794                            | 832,081                         | 148                                       | 67.2%   | 23,375                             | 2,338.6                                |
| 1996                                    | 5,855                             | 596,164                            | 859,721                         | 147                                       | 69.3%   | 24,892                             | 2,409.1                                |
| 1997                                    | 6,025                             | 620,029                            | 880,715                         | 146                                       | 70.4%   | 27,610                             | 2,514.2                                |
| 1998                                    | 6,220                             | 634,933                            | 899,029                         | 145                                       | 70.6%   | 28,015                             | 2,573.4                                |
| 1999                                    | 6,558                             | 668,626                            | 942,311                         | 144                                       | 71.0%   | 25,147                             | 2,653.1                                |
| 2000                                    | 6,946                             | 708,926                            | 981,080                         | 141                                       | 72.3%   | 30,221                             | 2,743.1                                |
| 2001                                    | 6,814                             | 664,849                            | 950,519                         | 139                                       | 69.9%   | 27,882                             | 2,599.4                                |
| 2002                                    | 6,834                             | 655,215                            | 913,898                         | 134                                       | 71.7%   | 30,507                             | 2,408.3                                |
| 2003                                    | 7,367                             | 674,160                            | 922,440                         | 125                                       | 73.1%   | 32,446                             | 2,402.3                                |
| 2004                                    | 7,479                             | 752,341                            | 1,000,193                       | 134                                       | 75.2%   | 37,958                             | 2,504.8                                |
| 2005                                    | 7,716                             | 795,117                            | 1,029,316                       | 133                                       | 77.2%   | 39,286                             | 2,606.8                                |
| 2006                                    | 8,220                             | 810,086                            | 1,027,526                       | 125                                       | 78.8%   | 38,251                             | 2,661.1                                |
| 2007                                    | 8,415                             | 842,007                            | 1,060,093                       | 126                                       | 79.4%   | 38,433                             | 2,684.6                                |
| 2008                                    | 8,145                             | 823,770                            | 1,040,618                       | 128                                       | 79.2%   | 35,529                             | 2,542.5                                |
| 2009                                    | 7,534                             | 779,982                            | 975,289                         | 129                                       | 80.0%   | 30,317                             | 2,303.2                                |
| <i>Average annual percentage change</i> |                                   |                                    |                                 |   |   |                                    |  |
| 1970–2009                               | 2.8%                              | 4.4%                               | 3.4%                            | 0.6%                                      |   | 5.5%                               | 1.4%                                   |
| 1999–2009                               | 1.4%                              | 1.6%                               | 0.3%                            | -1.1%                                     |   | 1.9%                               | -1.4%                                  |

**Sources:**

U.S. Department of Transportation, Bureau of Transportation Statistics, [www.transtats.bts.gov](http://www.transtats.bts.gov). (Additional resources: [www.bts.gov/programs/airline\\_information/air\\_carrier\\_traffic\\_statistics](http://www.bts.gov/programs/airline_information/air_carrier_traffic_statistics))

1970–76 Energy Use - Department of Transportation, Civil Aeronautics Board, *Fuel Cost and Consumption*, Washington, DC, 1981, and annual.

<sup>a</sup> Data are for all U.S. air carriers reporting on Form 41.

<sup>b</sup> Available seats per aircraft is calculated as the ratio of available seat-miles to revenue aircraft-miles.

<sup>c</sup> Passenger load factor is calculated as the ratio of revenue passenger-miles to available seat-miles for scheduled and nonscheduled services.

<sup>d</sup> Energy use includes fuel purchased abroad for international flights.



*General aviation includes: (1) aircraft operating under general operating and flight rules; (2) not-for-hire airplanes with a seating capacity of 20 or more or a maximum payload capacity of 6,000 lbs. or more; (3) rotorcraft external load operations; (4) on-demand and commuter operations not covered under Federal Aviation Regulations Part 121; and (5) agricultural aircraft operations.*

**Table 9.3**  
**Summary Statistics for General Aviation, 1970–2009**

| Calendar year                           | Total number of aircraft | Aircraft hours flown<br>(thousands) | Energy use (trillion btu) |
|---|--------------------------|-------------------------------------|---------------------------|
| 1970                                    | 131,700 <sup>a</sup>     | 26,030 <sup>b</sup>                 | 94.4                      |
| 1975                                    | 168,475                  | 30,298                              | 121.5                     |
| 1976                                    | 177,964                  | 31,950                              | 130.3                     |
| 1977                                    | 184,294                  | 33,679                              | 149.7                     |
| 1978                                    | 199,178                  | 36,844                              | 159.4                     |
| 1979                                    | 210,339                  | 40,432                              | 167.2                     |
| 1980                                    | 211,045                  | 41,016                              | 169.0                     |
| 1981                                    | 213,226                  | 40,704                              | 162.4                     |
| 1982                                    | 209,779                  | 36,457                              | 170.5                     |
| 1983                                    | 213,293                  | 35,249                              | 143.9                     |
| 1984                                    | 220,943                  | 36,119                              | 148.9                     |
| 1985                                    | 196,500                  | 31,456                              | 144.0                     |
| 1986                                    | 205,300                  | 31,782                              | 148.0                     |
| 1987                                    | 202,700                  | 30,883                              | 139.1                     |
| 1988                                    | 196,200                  | 31,114                              | 148.6                     |
| 1989                                    | 205,000                  | 32,332                              | 134.0                     |
| 1990                                    | 198,000                  | 32,096                              | 131.9                     |
| 1991                                    | 196,874                  | 29,862                              | 120.4                     |
| 1992                                    | 185,650                  | 26,747                              | 104.7                     |
| 1993                                    | 177,120                  | 24,455                              | 97.5                      |
| 1994                                    | 172,935                  | 24,092                              | 95.3                      |
| 1995                                    | 188,089                  | 26,612                              | 106.6                     |
| 1996                                    | 191,129                  | 26,909                              | 111.1                     |
| 1997                                    | 192,414                  | 27,713                              | 121.1                     |
| 1998                                    | 204,710                  | 28,100                              | 147.4                     |
| 1999                                    | 219,464                  | 31,231                              | 172.1                     |
| 2000                                    | 217,533                  | 29,960                              | 175.2                     |
| 2001                                    | 211,446                  | 27,017                              | 165.1                     |
| 2002                                    | 211,244                  | 27,040                              | 141.5                     |
| 2003                                    | 209,708                  | 27,329                              | 141.4                     |
| 2004                                    | 219,426                  | 28,126                              | 175.9                     |
| 2005                                    | 224,352                  | 26,982                              | 242.4                     |
| 2006                                    | 221,943                  | 27,705                              | 256.3                     |
| 2007                                    | 231,607                  | 27,852                              | 243.6                     |
| 2008                                    | 228,663                  | 26,009                              | 265.7                     |
| 2009                                    | 223,877                  | 23,763                              | 220.6                     |
| <i>Average annual percentage change</i> |                          |                                     |                           |
| 1970–2009                               | 1.4%                     | -0.2%                               | 2.2%                      |
| 1999–2009                               | 0.2%                     | -2.7%                               | 2.5%                      |

**Sources:**

U.S. Department of Transportation, Federal Aviation Administration, *General Aviation Activity and Avionics Survey: Calendar Year 2009*, Tables 1.2, 1.5, 5.1, and annual. (Additional resources: [www.faa.gov/data\\_statistics/aviation\\_data\\_statistics/general\\_aviation/CY2009/](http://www.faa.gov/data_statistics/aviation_data_statistics/general_aviation/CY2009/))

<sup>a</sup> Active fixed-wing general aviation aircraft only.

<sup>b</sup> Includes rotorcraft.





*In the early seventies, domestic waterborne commerce accounted for over 60% of total tonnage, but by 1994 foreign tonnage grew to more than half of all waterborne tonnage. Total foreign and domestic tons shipped were about 2.2 billion tons in 2009, down from a peak of 2.59 billion tons in 2006.*

**Table 9.4**  
**Tonnage Statistics for Domestic and**  
**International Waterborne Commerce, 1970–2009**  
**(million tons shipped)**

| Year                                    | Foreign and domestic total | Foreign total <sup>a</sup> | Domestic total <sup>b</sup> | Percent domestic of total |
|---|----------------------------|----------------------------|-----------------------------|---------------------------|
| 1970                                    | 1,532                      | 581                        | 951                         | 62.1%                     |
| 1975                                    | 1,695                      | 749                        | 946                         | 55.8%                     |
| 1976                                    | 1,835                      | 856                        | 979                         | 53.4%                     |
| 1977                                    | 1,908                      | 935                        | 973                         | 51.0%                     |
| 1978                                    | 2,021                      | 946                        | 1,075                       | 53.2%                     |
| 1979                                    | 2,073                      | 993                        | 1,080                       | 52.1%                     |
| 1980                                    | 1,999                      | 921                        | 1,077                       | 53.9%                     |
| 1981                                    | 1,942                      | 887                        | 1,054                       | 54.3%                     |
| 1982                                    | 1,777                      | 820                        | 957                         | 53.9%                     |
| 1983                                    | 1,708                      | 751                        | 957                         | 56.0%                     |
| 1984                                    | 1,836                      | 803                        | 1,033                       | 56.3%                     |
| 1985                                    | 1,788                      | 774                        | 1,014                       | 56.7%                     |
| 1986                                    | 1,874                      | 837                        | 1,037                       | 55.3%                     |
| 1987                                    | 1,967                      | 891                        | 1,076                       | 54.7%                     |
| 1988                                    | 2,088                      | 976                        | 1,112                       | 53.3%                     |
| 1989                                    | 2,140                      | 1,038                      | 1,103                       | 51.5%                     |
| 1990                                    | 2,164                      | 1,042                      | 1,122                       | 51.8%                     |
| 1991                                    | 2,092                      | 1,014                      | 1,079                       | 51.6%                     |
| 1992                                    | 2,132                      | 1,037                      | 1,095                       | 51.4%                     |
| 1993                                    | 2,128                      | 1,060                      | 1,068                       | 50.2%                     |
| 1994                                    | 2,215                      | 1,116                      | 1,099                       | 49.6%                     |
| 1995                                    | 2,240                      | 1,147                      | 1,093                       | 48.8%                     |
| 1996                                    | 2,284                      | 1,183                      | 1,101                       | 48.2%                     |
| 1997                                    | 2,333                      | 1,221                      | 1,113                       | 47.7%                     |
| 1998                                    | 2,340                      | 1,245                      | 1,094                       | 46.8%                     |
| 1999                                    | 2,323                      | 1,261                      | 1,062                       | 45.7%                     |
| 2000                                    | 2,425                      | 1,355                      | 1,070                       | 44.1%                     |
| 2001                                    | 2,393                      | 1,351                      | 1,042                       | 43.5%                     |
| 2002                                    | 2,340                      | 1,319                      | 1,021                       | 43.6%                     |
| 2003                                    | 2,394                      | 1,378                      | 1,016                       | 42.4%                     |
| 2004                                    | 2,552                      | 1,505                      | 1,047                       | 41.0%                     |
| 2005                                    | 2,527                      | 1,499                      | 1,029                       | 40.7%                     |
| 2006                                    | 2,588                      | 1,565                      | 1,023                       | 39.5%                     |
| 2007                                    | 2,564                      | 1,543                      | 1,022                       | 39.9%                     |
| 2008                                    | 2,477                      | 1,521                      | 956                         | 38.6%                     |
| 2009                                    | 2,211                      | 1,354                      | 857                         | 38.8%                     |
| <i>Average annual percentage change</i> |                            |                            |                             |                           |
| 1970–2009                               | 0.9%                       | 2.2%                       | -0.3%                       |                           |
| 1999–2009                               | -0.5%                      | 0.7%                       | -2.1%                       |                           |

**Source:**

U.S. Department of the Army, Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 2009*, New Orleans, Louisiana, 2010, Table 1-1. (Additional resources: [www.ndc.iwr.usace.army.mil](http://www.ndc.iwr.usace.army.mil))

<sup>a</sup> All movements between the United States and foreign countries and between Puerto Rico and the Virgin Islands and foreign countries are classified as foreign trade.

<sup>b</sup> All movements between U.S. ports, continental and noncontiguous, and on the inland rivers, canals, and connecting channels of the United States, Puerto Rico, and the Virgin Islands, excluding the Panama Canal. Beginning in 1996, fish was excluded for internal and intra port domestic traffic.



*The U.S. Army Corps of Engineers Navigation Data Center collects a wealth of waterborne commerce data. Energy use data, however, have never been collected as part of this effort. The energy use data collected by the Energy Information Administration (EIA) on vessel bunkering was formerly displayed on this table. The EIA data include different uses of fuel, not just fuel for domestic waterborne commerce; therefore it was misleading to display those data together.*

**Table 9.5**  
**Summary Statistics for Domestic Waterborne Commerce, 1970–2009**

| Year                                    | Number of vessels <sup>a</sup> | Ton-miles<br>(billions) | Tons shipped <sup>b</sup> (millions) | Average length of haul<br>(miles) |
|---|--------------------------------|-------------------------|--------------------------------------|-----------------------------------|
| 1970                                    | 25,832                         | 596                     | 949                                  | 628.2                             |
| 1975                                    | 31,666                         | 566                     | 944                                  | 599.9                             |
| 1980                                    | 38,792                         | 922                     | 1,074                                | 856.4                             |
| 1985                                    | 41,672                         | 893                     | 1,011                                | 883.5                             |
| 1986                                    | 40,308                         | 873                     | 1,033                                | 845.3                             |
| 1987                                    | 40,000                         | 895                     | 1,072                                | 835.0                             |
| 1988                                    | 39,192                         | 890                     | 1,106                                | 804.3                             |
| 1989                                    | 39,209                         | 816                     | 1,097                                | 743.2                             |
| 1990                                    | 41,119                         | 834                     | 1,118                                | 745.7                             |
| 1991                                    | 39,233                         | 848                     | 1,074                                | 789.9                             |
| 1992                                    | 39,210                         | 857                     | 1,090                                | 785.7                             |
| 1993                                    | 39,064                         | 790                     | 1,063                                | 742.7                             |
| 1994                                    | 39,064                         | 815                     | 1,093                                | 745.5                             |
| 1995                                    | 39,445                         | 808                     | 1,086                                | 743.6                             |
| 1996                                    | 41,104                         | 765                     | 1,093                                | 699.4                             |
| 1997                                    | 41,419                         | 707                     | 1,106                                | 639.5                             |
| 1998                                    | 42,032                         | 673                     | 1,087                                | 619.0                             |
| 1999                                    | 41,766                         | 656                     | 1,056                                | 621.1                             |
| 2000                                    | 39,641                         | 646                     | 1,064                                | 606.8                             |
| 2001                                    | 41,588                         | 622                     | 1,037                                | 599.7                             |
| 2002                                    | 41,002                         | 612                     | 1,016                                | 602.5                             |
| 2003                                    | 39,983                         | 606                     | 1,010                                | 600.3                             |
| 2004                                    | 40,290                         | 621                     | 1,042                                | 596.4                             |
| 2005                                    | 41,354                         | 591                     | 1,024                                | 577.4                             |
| 2006                                    | 41,109                         | 562                     | 1,018                                | 548.7                             |
| 2007                                    | 40,695                         | 553                     | 1,016                                | 544.2                             |
| 2008                                    | 40,301                         | 521                     | 952                                  | 546.7                             |
| 2009                                    | 40,109                         | 477                     | 852                                  | 559.7                             |
| <i>Average annual percentage change</i> |                                |                         |                                      |                                   |
| 1970–2009                               | 1.1%                           | -0.6%                   | -0.3%                                | -0.3%                             |
| 1999–2009                               | -0.4%                          | -3.1%                   | -2.1%                                | -1.0%                             |

**Sources:**

Number of vessels -1970–92, 1995–2006 - U.S. Department of the Army, Corps of Engineers, *Waterborne Transportation Lines of the United States*, 2009, New Orleans, LA, 2010, Table 2, p. 6, and annual. 1993–94 - U.S. Department of the Army, Corps of Engineers, *The U.S. Waterway System-Facts*, Navigation Data Center, New Orleans, Louisiana, January 1996.

Ton-miles, tons shipped, average length of haul - U.S. Department of the Army, Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 2009, Part 5: National Summaries*, New Orleans, LA, 2010, Table 1-4, pp. 1-6, 1-7, and annual. (Additional resources: [www.iwr.usace.army.mil/ndc](http://www.iwr.usace.army.mil/ndc))

<sup>a</sup> Grand total for self-propelled and non-self-propelled.

<sup>b</sup> These figures are not consistent with the figures on Table 9.3 because intra-territory tons are not included in this table. Intra-territory traffic is traffic between ports in Puerto Rico and the Virgin Islands.



*The data displayed in this table come from the Environmental Protection Agency's NONROAD2008a model.*

**Table 9.6**  
**Recreational Boat Energy Use, 1970–2009**

| Year                                    | Number of boats<br>(thousands) | Diesel fuel | Gasoline<br>(trillion Btu) | Total energy use |
|---|--------------------------------|-------------|----------------------------|------------------|
| 1970                                    | 10,087                         | 5.5         | 151.7                      | 157.2            |
| 1971                                    | 10,137                         | 6.5         | 152.6                      | 159.2            |
| 1972                                    | 10,187                         | 7.6         | 153.6                      | 161.2            |
| 1973                                    | 10,237                         | 8.6         | 154.5                      | 163.2            |
| 1974                                    | 10,287                         | 9.7         | 155.5                      | 165.1            |
| 1975                                    | 10,337                         | 10.7        | 156.4                      | 167.1            |
| 1976                                    | 10,387                         | 11.8        | 157.4                      | 169.1            |
| 1977                                    | 10,437                         | 12.8        | 158.3                      | 171.1            |
| 1978                                    | 10,487                         | 13.9        | 159.3                      | 173.1            |
| 1979                                    | 10,537                         | 14.9        | 160.2                      | 175.1            |
| 1980                                    | 10,587                         | 16.0        | 161.2                      | 177.1            |
| 1981                                    | 10,637                         | 17.0        | 162.1                      | 179.1            |
| 1982                                    | 10,687                         | 18.0        | 163.1                      | 181.1            |
| 1983                                    | 10,737                         | 19.1        | 164.0                      | 183.1            |
| 1984                                    | 10,787                         | 20.1        | 165.0                      | 185.1            |
| 1985                                    | 10,837                         | 21.2        | 165.9                      | 187.1            |
| 1986                                    | 10,887                         | 22.2        | 166.9                      | 189.1            |
| 1987                                    | 10,937                         | 23.3        | 167.8                      | 191.1            |
| 1988                                    | 11,030                         | 24.3        | 170.4                      | 194.7            |
| 1989                                    | 11,122                         | 25.4        | 172.9                      | 198.3            |
| 1990                                    | 11,215                         | 26.4        | 175.4                      | 201.8            |
| 1991                                    | 11,327                         | 27.5        | 178.7                      | 206.2            |
| 1992                                    | 11,440                         | 28.5        | 182.0                      | 210.5            |
| 1993                                    | 11,553                         | 29.5        | 185.3                      | 214.8            |
| 1994                                    | 11,770                         | 30.6        | 192.5                      | 223.1            |
| 1995                                    | 11,988                         | 31.6        | 199.7                      | 231.3            |
| 1996                                    | 12,206                         | 32.7        | 206.8                      | 239.5            |
| 1997                                    | 12,244                         | 33.7        | 207.2                      | 240.9            |
| 1998                                    | 12,283                         | 34.8        | 207.4                      | 242.2            |
| 1999                                    | 12,321                         | 35.8        | 207.1                      | 243.0            |
| 2000                                    | 12,359                         | 36.8        | 206.6                      | 243.4            |
| 2001                                    | 12,464                         | 37.9        | 206.9                      | 244.9            |
| 2002                                    | 12,568                         | 39.0        | 206.7                      | 245.7            |
| 2003                                    | 12,673                         | 40.2        | 206.0                      | 246.2            |
| 2004                                    | 12,777                         | 41.3        | 205.0                      | 246.2            |
| 2005                                    | 12,882                         | 42.4        | 203.7                      | 246.1            |
| 2006                                    | 12,984                         | 43.5        | 202.5                      | 245.9            |
| 2007                                    | 13,086                         | 44.6        | 201.2                      | 245.8            |
| 2008                                    | 13,189                         | 45.7        | 200.0                      | 245.7            |
| 2009                                    | 13,291                         | 46.8        | 198.8                      | 245.6            |
| <i>Average annual percentage change</i> |                                |             |                            |                  |
| 1970–2009                               | 0.7%                           | 5.6%        | 0.7%                       | 0.0%             |
| 1999–2009                               | 0.8%                           | 2.7%        | -0.4%                      | 0.1%             |

**Source:**

U.S. Environmental Protection Agency, NONROAD2008a model, downloadable file from  
<http://www.epa.gov/otaq/nonrdmdl.htm>.



*The Interstate Commerce Commission designates Class I railroads on the basis of annual gross revenues. In 2009, seven railroads were given this designation. The number of railroads designated as Class I has changed considerably in the last 30 years; in 1976 there were 52 railroads given Class I designation. For detailed information by railroad, see the 2010 Vehicle Technologies Market Report at url [http://www1.eere.energy.gov/vehiclesandfuels/pdfs/2010\\_vt\\_market\\_rpt.pdf](http://www1.eere.energy.gov/vehiclesandfuels/pdfs/2010_vt_market_rpt.pdf).*

**Table 9.7**  
**Class I Railroad Freight Systems in the United States**  
**Ranked by Revenue Ton-Miles, 2009**

| Railroad   | Revenue ton-miles<br>(billions) | Percent       |
|--|---------------------------------|---------------|
| Burlington Northern and Santa Fe Railway Company | 594                             | 38.7%         |
| Union Pacific Railroad Company                   | 479                             | 31.2%         |
| CSX Transportation                               | 209                             | 13.6%         |
| Norfolk Southern Railway                         | 159                             | 10.4%         |
| Canadian National, Grand Trunk Corporation       | 43                              | 2.8%          |
| Kansas City Southern Railway Company             | 29                              | 1.9%          |
| Soo Line Railroad Company                        | 20                              | 1.3%          |
| <b>Total</b>                                     | <b>1,533</b>                    | <b>100.0%</b> |

**Source:**

Association of American Railroads, *Railroad Facts, 2010 Edition*, Washington, DC, November 2010, p. 66.  
 (Additional resources: [www.aar.org](http://www.aar.org))



Revenue ton-miles for Class I freight railroads was over 1.7 trillion in 2009. Though there are many regional and local freight railroads, the Class I freight railroads accounted for 93% of the railroad industry's freight revenue in 2009 and 67% of the industry's mileage operated. The energy intensity of Class I railroads hit an all-time low of 291 btu/ton-mile in 2009.

**Table 9.8**  
**Summary Statistics for Class I Freight Railroads, 1970–2009**

| Year                                    | Number of locomotives in service <sup>a</sup> | Number of freight cars (thousands) <sup>b</sup> | Train-miles (millions) | Car-miles (millions) | Tons originated <sup>c</sup> (millions) | Average length of haul (miles) | Revenue ton-miles (millions) | Energy intensity (Btu/ton-mile) | Energy use (trillion Btu) |
|---|---|---|------------------------|----------------------|---|--------------------------------|------------------------------|---------------------------------|---------------------------|
| 1970                                    | 27,077 <sup>d</sup>                           | 1,424   | 427                    | 29,890               | 1,485                                   | 515                            | 764,809                      | 691                             | 528.1                     |
| 1975                                    | 27,846  | 1,359   | 403                    | 27,656               | 1,395                                   | 541                            | 754,252                      | 687                             | 518.3                     |
| 1980                                    | 28,094  | 1,168   | 428                    | 29,277               | 1,492                                   | 616                            | 918,958                      | 597                             | 548.7                     |
| 1981                                    | 27,421  | 1,111   | 408                    | 27,968               | 1,453                                   | 626                            | 910,169                      | 572                             | 521.0                     |
| 1982                                    | 26,795  | 1,039   | 345                    | 23,952               | 1,269                                   | 629                            | 797,759                      | 553                             | 440.8                     |
| 1983                                    | 25,448  | 1,007   | 346                    | 24,358               | 1,293                                   | 641                            | 828,275                      | 525                             | 435.1                     |
| 1984                                    | 24,117  | 948   | 369                    | 26,409               | 1,429                                   | 645                            | 921,542                      | 510                             | 469.9                     |
| 1985                                    | 22,548  | 867   | 347                    | 24,920               | 1,320                                   | 665                            | 876,984                      | 497                             | 436.1                     |
| 1986                                    | 20,790  | 799   | 347                    | 24,414               | 1,306                                   | 664                            | 867,722                      | 486                             | 421.5                     |
| 1987                                    | 19,647  | 749   | 361                    | 25,627               | 1,372                                   | 688                            | 943,747                      | 456                             | 430.3                     |
| 1988                                    | 19,364  | 725   | 379                    | 26,339               | 1,430                                   | 697                            | 996,182                      | 443                             | 441.4                     |
| 1989                                    | 19,015  | 682   | 383                    | 26,196               | 1,403                                   | 723                            | 1,013,841                    | 437                             | 442.6                     |
| 1990                                    | 18,835  | 659   | 380                    | 26,159               | 1,425                                   | 726                            | 1,033,969                    | 420                             | 434.7                     |
| 1991                                    | 18,344  | 633   | 375                    | 25,628               | 1,383                                   | 751                            | 1,038,875                    | 391                             | 405.8                     |
| 1992                                    | 18,004  | 605   | 390                    | 26,128               | 1,399                                   | 763                            | 1,066,781                    | 393                             | 419.2                     |
| 1993                                    | 18,161  | 587   | 405                    | 26,883               | 1,397                                   | 794                            | 1,109,309                    | 389                             | 431.6                     |
| 1994                                    | 18,505  | 591   | 441                    | 28,485               | 1,470                                   | 817                            | 1,200,701                    | 388                             | 465.4                     |
| 1995                                    | 18,812  | 583   | 458                    | 30,383               | 1,550                                   | 843                            | 1,305,688                    | 372                             | 485.9                     |
| 1996                                    | 19,269  | 571   | 469                    | 31,715               | 1,611                                   | 842                            | 1,355,975                    | 368                             | 499.4                     |
| 1997                                    | 19,684  | 568   | 475                    | 31,660               | 1,585                                   | 851                            | 1,348,926                    | 370                             | 499.7                     |
| 1998                                    | 20,261  | 576   | 475                    | 32,657               | 1,649                                   | 835                            | 1,376,802                    | 365                             | 502.0                     |
| 1999                                    | 20,256  | 579   | 490                    | 33,851               | 1,717                                   | 835                            | 1,433,461                    | 363                             | 520.0                     |
| 2000                                    | 20,028  | 560   | 504                    | 34,590               | 1,738                                   | 843                            | 1,465,960                    | 352                             | 516.0                     |
| 2001                                    | 19,745  | 500   | 500                    | 34,243               | 1,742                                   | 859                            | 1,495,472                    | 346                             | 517.3                     |
| 2002                                    | 20,506  | 478   | 500                    | 34,680               | 1,767                                   | 853                            | 1,507,011                    | 345                             | 520.3                     |
| 2003                                    | 20,774  | 467   | 516                    | 35,555               | 1,799                                   | 862                            | 1,551,438                    | 344                             | 533.9                     |
| 2004                                    | 22,015  | 474   | 535                    | 37,071               | 1,844                                   | 902                            | 1,662,598                    | 341                             | 566.2                     |
| 2005                                    | 22,779  | 475   | 548                    | 37,712               | 1,899                                   | 894                            | 1,696,425                    | 337                             | 571.4                     |
| 2006                                    | 23,732  | 475   | 563                    | 38,995               | 1,957                                   | 906                            | 1,771,897                    | 330                             | 584.5                     |
| 2007                                    | 24,143  | 460   | 543                    | 38,186               | 1,940                                   | 913                            | 1,770,545                    | 320                             | 566.9                     |
| 2008                                    | 24,003  | 450   | 524                    | 37,226               | 1,934                                   | 919                            | 1,777,236                    | 305                             | 542.5                     |
| 2009                                    | 24,045  | 416   | 436                    | 32,115               | 1,668                                   | 919                            | 1,532,214                    | 291                             | 446.6                     |
| <i>Average annual percentage change</i> |   |   |                        |                      |   |                                |                              |                                 |                           |
| 1970–2009                               | -0.3%   | -3.1%   | 0.1%                   | 0.2%                 | 0.3%                                    | 1.5%                           | 1.8%                         | -2.2%                           | -0.4%                     |
| 1999–2009                               | 1.7%  | -3.3%   | -1.2%                  | -0.5%                | -0.3%                                   | 1.0%                           | 0.7%                         | -2.2%                           | -1.5%                     |

**Source:**

Association of American Railroads, *Railroad Facts, 2010 Edition*, Washington, DC, November 2010, pp. 27, 28, 33, 34, 36, 49, 52, 61. (Additional resources: [www.aar.org](http://www.aar.org))

<sup>a</sup> Does not include self-powered units.

<sup>b</sup> Does not include private or shipper-owned cars. Beginning in 2001, Canadian-owned U.S. railroads are excluded.

<sup>c</sup> Tons originated is a more accurate representation of total tonnage than revenue tons. Revenue tons often produces double-counting of loads switched between rail companies.

<sup>d</sup> Data represent total locomotives used in freight and passenger service. Separate estimates are not available.



According to the 2007 Commodity Flow Survey, 7% of all freight ton-miles are rail intermodal shipments (truck/rail or rail/water). See Table 5.15 for details. The number of trailers and containers moved by railroads has increased almost six-fold from 1965 to 2009. Containerization has increased in the last two decades, evidenced by the 258% increase in the number of containers from 1988 to 2009. The number of trailers moved by rail, however, fell to an all-time low in 2009.

**Table 9.9**  
**Intermodal Rail Traffic, 1965–2009<sup>a</sup>**

| Year                                    | Trailers & containers | Trailers     | Containers   |
|---|-----------------------|--------------|--------------|
| 1965                                    | 1,664,929             | <sup>b</sup> | <sup>b</sup> |
| 1970                                    | 2,363,200             | <sup>b</sup> | <sup>b</sup> |
| 1975                                    | 2,238,117             | <sup>b</sup> | <sup>b</sup> |
| 1980                                    | 3,059,402             | <sup>b</sup> | <sup>b</sup> |
| 1981                                    | 3,150,522             | <sup>b</sup> | <sup>b</sup> |
| 1982                                    | 3,396,973             | <sup>b</sup> | <sup>b</sup> |
| 1983                                    | 4,090,078             | <sup>b</sup> | <sup>b</sup> |
| 1984                                    | 4,565,743             | <sup>b</sup> | <sup>b</sup> |
| 1985                                    | 4,590,952             | <sup>b</sup> | <sup>b</sup> |
| 1986                                    | 4,997,229             | <sup>b</sup> | <sup>b</sup> |
| 1987                                    | 5,503,819             | <sup>b</sup> | <sup>b</sup> |
| 1988                                    | 5,779,547             | 3,481,020    | 2,298,527    |
| 1989                                    | 5,987,355             | 3,496,262    | 2,491,093    |
| 1990                                    | 6,206,782             | 3,451,953    | 2,754,829    |
| 1991                                    | 6,246,134             | 3,201,560    | 3,044,574    |
| 1992                                    | 6,627,841             | 3,264,597    | 3,363,244    |
| 1993                                    | 7,156,628             | 3,464,126    | 3,692,502    |
| 1994                                    | 8,128,228             | 3,752,502    | 4,375,726    |
| 1995                                    | 7,936,172             | 3,492,463    | 4,443,709    |
| 1996                                    | 8,143,258             | 3,302,128    | 4,841,130    |
| 1997                                    | 8,698,308             | 3,453,907    | 5,244,401    |
| 1998                                    | 8,772,663             | 3,353,032    | 5,419,631    |
| 1999                                    | 8,907,626             | 3,207,407    | 5,700,219    |
| 2000                                    | 9,176,890             | 2,888,630    | 6,288,260    |
| 2001                                    | 8,935,444             | 2,603,423    | 6,332,021    |
| 2002                                    | 9,312,360             | 2,531,338    | 6,781,022    |
| 2003                                    | 9,955,605             | 2,625,837    | 7,329,768    |
| 2004                                    | 10,993,662            | 2,928,123    | 8,065,539    |
| 2005                                    | 11,693,512            | 2,979,906    | 8,713,606    |
| 2006                                    | 12,282,221            | 2,882,699    | 9,399,522    |
| 2007                                    | 12,026,631            | 2,600,635    | 9,425,996    |
| 2008                                    | 11,499,978            | 2,478,890    | 9,021,088    |
| 2009                                    | 9,880,602             | 1,640,672    | 8,239,930    |
| <i>Average annual percentage change</i> |                       |              |              |
| 1965–2009                               | 4.1%                  | <sup>b</sup> | <sup>b</sup> |
| 1999–2009                               | 1.0%                  | -6.5%        | 3.8%         |

**Source:**

Association of American Railroads, *Railroad Facts, 2010 Edition*, Washington, DC, November 2010, p. 26.

Additional resources: [www.aar.org](http://www.aar.org))

<sup>a</sup> Beginning in 1995, the Grand Trunk Western Railroad and the Soo Line Railroad Company are excluded. Beginning in 1999, the Illinois Central data are excluded. Beginning in 2002, the Wisconsin Central data are excluded.

<sup>b</sup> Data are not available.



*The National Railroad Passenger Corporation, known as Amtrak, began operation in 1971. Amtrak revenue passenger-miles have grown at an average annual rate of 2.9% from 1971 to 2009.*

**Table 9.10**  
**Summary Statistics for the National Railroad Passenger Corporation (Amtrak), 1971–2009**

| Year                                    | Number of locomotives in service | Number of passenger cars | Train-miles (thousands) | Car-miles (thousands) | Revenue passenger-miles (millions) | Average trip length (miles) | Energy intensity (Btu per revenue passenger-mile) | Energy use (trillion Btu) |
|---|----------------------------------|--------------------------|-------------------------|-----------------------|------------------------------------|-----------------------------|---|---------------------------|
| 1971                                    | <sup>a</sup>                     | 1,165                    | 16,537                  | 140,147               | 1,993                              | 188                         | <sup>a</sup>                                      | <sup>a</sup>              |
| 1975                                    | 355                              | 1,913                    | 30,166                  | 253,898               | 3,753                              | 224                         | 3,548   | 13.3                      |
| 1980                                    | 448                              | 2,128                    | 29,487                  | 235,235               | 4,503                              | 217                         | 3,065   | 13.8                      |
| 1981                                    | 398                              | 1,830                    | 30,380                  | 222,753               | 4,397                              | 226                         | 2,883   | 12.7                      |
| 1982                                    | 396                              | 1,929                    | 28,833                  | 217,385               | 3,993                              | 220                         | 3,052   | 12.2                      |
| 1983                                    | 388                              | 1,880                    | 28,805                  | 223,509               | 4,227                              | 223                         | 2,875   | 12.2                      |
| 1984                                    | 387                              | 1,844                    | 29,133                  | 234,557               | 4,427                              | 227                         | 2,923   | 12.9                      |
| 1985                                    | 382                              | 1,818                    | 30,038                  | 250,642               | 4,785                              | 238                         | 2,703   | 12.9                      |
| 1986                                    | 369                              | 1,793                    | 28,604                  | 249,665               | 5,011                              | 249                         | 2,481   | 12.4                      |
| 1987                                    | 381                              | 1,850                    | 29,515                  | 261,054               | 5,361                              | 259                         | 2,450   | 13.1                      |
| 1988                                    | 391                              | 1,845                    | 30,221                  | 277,774               | 5,686                              | 265                         | 2,379   | 13.5                      |
| 1989                                    | 312                              | 1,742                    | 31,000                  | 285,255               | 5,859                              | 274                         | 2,614   | 15.3                      |
| 1990                                    | 318                              | 1,863                    | 33,000                  | 300,996               | 6,057                              | 273                         | 2,505   | 15.2                      |
| 1991                                    | 316                              | 1,786                    | 34,000                  | 312,484               | 6,273                              | 285                         | 2,417   | 15.2                      |
| 1992                                    | 336                              | 1,796                    | 34,000                  | 307,282               | 6,091                              | 286                         | 2,534   | 15.4                      |
| 1993                                    | 360                              | 1,853                    | 34,936                  | 302,739               | 6,199                              | 280                         | 2,565   | 15.9                      |
| 1994                                    | 411                              | 1,874                    | 34,940                  | 305,600               | 5,869                              | 276                         | 2,282   | 13.4 <sup>b</sup>         |
| 1995                                    | 422                              | 1,907                    | 31,579                  | 282,579               | 5,401                              | 266                         | 2,501   | 13.5                      |
| 1996                                    | 348                              | 1,501                    | 30,542                  | 277,750               | 5,066                              | 257                         | 2,690   | 13.6                      |
| 1997                                    | 292                              | 1,572                    | 32,000                  | 287,760               | 5,166                              | 255                         | 2,811   | 14.5                      |
| 1998                                    | 362                              | 1,347                    | 32,926                  | 315,823               | 5,325                              | 251                         | 2,788   | 14.8                      |
| 1999                                    | 385                              | 1,285                    | 34,080                  | 349,337               | 5,289                              | 245                         | 2,943   | 15.6                      |
| 2000                                    | 385                              | 1,891                    | 35,404                  | 371,215               | 5,574                              | 243                         | 3,235   | 18.0                      |
| 2001                                    | 401                              | 2,084                    | 36,512                  | 377,705               | 5,571                              | 238                         | 3,257   | 18.1                      |
| 2002                                    | 372                              | 2,896                    | 37,624                  | 378,542               | 5,314                              | 228                         | 3,212   | 17.1                      |
| 2003                                    | 442                              | 1,623                    | 37,459                  | 331,864               | 5,680                              | 231                         | 2,800   | 15.9                      |
| 2004                                    | 276                              | 1,211                    | 37,159                  | 308,437               | 5,511                              | 219                         | 2,760   | 15.2                      |
| 2005                                    | 258                              | 1,186                    | 36,199                  | 264,796               | 5,381                              | 215                         | 2,709   | 14.6                      |
| 2006                                    | 319                              | 1,191                    | 36,083                  | 263,908               | 5,410                              | 220                         | 2,650   | 14.3                      |
| 2007                                    | 270                              | 1,164                    | 37,484                  | 266,545               | 5,784                              | 218                         | 2,516   | 14.5                      |
| 2008                                    | 278                              | 1,177                    | 37,736                  | 271,762               | 6,179                              | 215                         | 2,398   | 14.8                      |
| 2009                                    | 274                              | 1,214                    | 38,300                  | 282,764               | 5,914                              | 217                         | 2,435   | 14.4                      |
| <i>Average annual percentage change</i> |                                  |                          |                         |                       |                                    |                             |   |                           |
| 1971–2009                               | <sup>a</sup>                     | 0.1%                     | 2.2%                    | 1.9%                  | 2.9%                               | 0.4%                        | <sup>a</sup>                                      | <sup>a</sup>              |
| 1999–2009                               | -3.3%                            | -0.6%                    | 1.2%                    | -2.1%                 | 0.6%                               | -1.1%                       | -2.8%   | -0.8%                     |

**Sources:**

1971–83- Association of American Railroads, Economics and Finance Department, *Statistics of Class I Railroads*, Washington, DC, and annual.

1984–88- Association of American Railroads, *Railroad Facts*, 1988 Edition, Washington, DC, December 1989, p. 61, and annual.

1989–93- Personal communication with the Corporate Accounting Office of Amtrak, Washington, D.C.

1994–2009 - Number of locomotives in service, number of passenger cars, train-miles, car-miles, revenue passenger-miles, and average trip length - Association of American Railroads, *Railroad Facts*, 2010 Edition, Washington, DC, 2010, p. 77.

Energy use - Personal communication with the Amtrak, Washington, DC. (Additional resources: [www.amtrak.com](http://www.amtrak.com), [www.aar.org](http://www.aar.org))

<sup>a</sup> Data are not available.

<sup>b</sup> Energy use for 1994 on is not directly comparable to earlier years. Some commuter rail energy use may have been inadvertently included in earlier years.



*Commuter rail, which is also known as regional rail or suburban rail, is long-haul rail passenger service operating between metropolitan and suburban areas, whether within or across state lines. Commuter rail lines usually have reduced fares for multiple rides and commutation tickets for regular, recurring riders.*

**Table 9.11**  
**Summary Statistics for Commuter Rail Operations, 1984–2009**

| Year                                    | Number of<br>passenger<br>vehicles | Vehicle-<br>miles<br>(millions) | Passenger<br>trips<br>(millions) | Passenger-<br>miles<br>(millions) | Average<br>trip length<br>(miles) | Energy intensity<br>(Btu/passenger-<br>mile) | Energy<br>use<br>(trillion<br>Btu) |
|---|------------------------------------|---------------------------------|----------------------------------|-----------------------------------|-----------------------------------|--|------------------------------------|
| 1984                                    | 4,075                              | 167.9                           | 267                              | 6,207                             | 23.2                              | 2,804  | 17.4                               |
| 1985                                    | 4,035                              | 182.7                           | 275                              | 6,534                             | 23.8                              | 2,826  | 18.5                               |
| 1986                                    | 4,440                              | 188.6                           | 306                              | 6,723                             | 22.0                              | 2,926  | 19.7                               |
| 1987                                    | 4,686                              | 188.9                           | 311                              | 6,818                             | 21.9                              | 2,801  | 19.1                               |
| 1988                                    | 4,649                              | 202.2                           | 325                              | 6,964                             | 21.4                              | 2,872  | 19.7                               |
| 1989                                    | 4,472                              | 209.6                           | 330                              | 7,211                             | 21.9                              | 2,864  | 20.7                               |
| 1990                                    | 4,982                              | 212.7                           | 328                              | 7,082                             | 21.6                              | 2,822  | 20.0                               |
| 1991                                    | 5,126                              | 214.9                           | 318                              | 7,344                             | 23.1                              | 2,770  | 20.3                               |
| 1992                                    | 5,164                              | 218.8                           | 314                              | 7,320                             | 23.3                              | 2,629  | 19.2                               |
| 1993                                    | 4,982                              | 223.9                           | 322                              | 6,940                             | 21.6                              | 2,976  | 20.7                               |
| 1994                                    | 5,126                              | 230.8                           | 339                              | 7,996                             | 23.6                              | 2,682  | 21.4                               |
| 1995                                    | 5,164                              | 237.7                           | 344                              | 8,244                             | 24.0                              | 2,632  | 21.7                               |
| 1996                                    | 5,240                              | 241.9                           | 352                              | 8,351                             | 23.7                              | 2,582  | 21.6                               |
| 1997                                    | 5,426                              | 250.7                           | 357                              | 8,038                             | 22.5                              | 2,724  | 21.9                               |
| 1998                                    | 5,536                              | 259.5                           | 381                              | 8,704                             | 22.8                              | 2,646  | 23.0                               |
| 1999                                    | 5,550                              | 265.9                           | 396                              | 8,766                             | 22.1                              | 2,714  | 23.8                               |
| 2000                                    | 5,498                              | 270.9                           | 413                              | 9,402                             | 22.8                              | 2,551  | 24.0                               |
| 2001                                    | 5,572                              | 277.3                           | 419                              | 9,548                             | 22.8                              | 2,515  | 24.0                               |
| 2002                                    | 5,724                              | 283.7                           | 414                              | 9,504                             | 22.9                              | 2,514  | 23.9                               |
| 2003                                    | 5,959                              | 286.0                           | 410                              | 9,559                             | 23.3                              | 2,545  | 24.3                               |
| 2004                                    | 6,228                              | 294.7                           | 414                              | 9,719                             | 23.5                              | 2,569  | 25.0                               |
| 2005                                    | 6,392                              | 303.4                           | 423                              | 9,473                             | 22.4                              | 2,743  | 26.0                               |
| 2006                                    | 6,403                              | 314.7                           | 441                              | 10,361                            | 23.5                              | 2,527  | 26.2                               |
| 2007                                    | 6,391                              | 325.7                           | 459                              | 11,153                            | 24.3                              | 2,638  | 29.4                               |
| 2008                                    | 6,617                              | 310.2                           | 472                              | 11,049                            | 23.4                              | 2,656  | 29.3                               |
| 2009                                    | 6,941                              | 343.5                           | 468                              | 11,232                            | 24.0                              | 2,812  | 31.6                               |
| <i>Average annual percentage change</i> |                                    |                                 |                                  |                                   |                                   |  |                                    |
| 1984–2009                               | 2.2%                               | 2.9%                            | 2.3%                             | 2.4%                              | 0.1%                              |  |                                    |
| 1999–2009                               | 2.3%                               | 2.6%                            | 1.7%                             | 2.5%                              | 0.8%                              |  |                                    |

**Source:**

American Public Transportation Association, *2011 Public Transportation Fact Book*, Washington, DC, April 2011, Tables 5, 6, 8, and 9. (Additional resources: [www.apta.com](http://www.apta.com))





*This table on transit rail operations includes data on light rail and heavy rail systems. Light rail vehicles are usually single vehicles driven electrically with power drawn from overhead wires. Heavy rail is characterized by high speed and rapid acceleration of rail cars operating on a separate right-of-way.*

**Table 9.12**  
**Summary Statistics for Rail Transit Operations, 1970–2009<sup>a</sup>**

| Year                                    | Number of passenger vehicles | Vehicle-miles (millions) | Passenger trips (millions) <sup>b</sup> | Passenger-miles (millions) <sup>c</sup> | Average trip length (miles) <sup>d</sup> | Energy intensity (Btu/passenger-mile) <sup>e</sup> | Energy use (trillion Btu) |
|---|------------------------------|--------------------------|---|---|--|--|---------------------------|
| 1970                                    | 10,548                       | 440.8                    | 2,116                                   | 12,273                                  | <sup>f</sup>                             | 2,157  | 26.5                      |
| 1975                                    | 10,617                       | 446.9                    | 1,797                                   | 10,423                                  | <sup>f</sup>                             | 2,625  | 27.4                      |
| 1980                                    | 10,654                       | 402.2                    | 2,241                                   | 10,939                                  | 4.9                                      | 2,312  | 25.3                      |
| 1981                                    | 10,824                       | 436.6                    | 2,217                                   | 10,590                                  | 4.8                                      | 2,592  | 27.5                      |
| 1982                                    | 10,831                       | 445.2                    | 2,201                                   | 10,428                                  | 4.7                                      | 2,699  | 28.1                      |
| 1983                                    | 10,904                       | 423.5                    | 2,304                                   | 10,741                                  | 4.7                                      | 2,820  | 30.3                      |
| 1984                                    | 10,848                       | 452.7                    | 2,388                                   | 10,531                                  | 4.4                                      | 3,037  | 32.0                      |
| 1985                                    | 11,109                       | 467.8                    | 2,422                                   | 10,777                                  | 4.4                                      | 2,809  | 30.3                      |
| 1986                                    | 11,083                       | 492.8                    | 2,467                                   | 11,018                                  | 4.5                                      | 3,042  | 33.5                      |
| 1987                                    | 10,934                       | 508.6                    | 2,535                                   | 11,603                                  | 4.6                                      | 3,039  | 35.3                      |
| 1988                                    | 11,370                       | 538.3                    | 2,462                                   | 11,836                                  | 4.8                                      | 3,072  | 36.2                      |
| 1989                                    | 11,261                       | 553.4                    | 2,704                                   | 12,539                                  | 4.6                                      | 2,909  | 36.5                      |
| 1990                                    | 11,332                       | 560.9                    | 2,521                                   | 12,046                                  | 4.8                                      | 3,024  | 36.4                      |
| 1991                                    | 11,426                       | 554.8                    | 2,356                                   | 11,190                                  | 4.7                                      | 3,254  | 36.4                      |
| 1992                                    | 11,303                       | 554.0                    | 2,395                                   | 11,438                                  | 4.8                                      | 3,155  | 36.1                      |
| 1993                                    | 11,286                       | 549.8                    | 2,234                                   | 10,936                                  | 4.9                                      | 3,373  | 36.9                      |
| 1994                                    | 11,192                       | 565.8                    | 2,453                                   | 11,501                                  | 4.7                                      | 3,338  | 38.4                      |
| 1995                                    | 11,156                       | 571.8                    | 2,284                                   | 11,419                                  | 5.0                                      | 3,340  | 38.1                      |
| 1996                                    | 11,341                       | 580.7                    | 2,418                                   | 12,487                                  | 5.2                                      | 3,017  | 37.7                      |
| 1997                                    | 11,471                       | 598.9                    | 2,692                                   | 13,091                                  | 4.9                                      | 2,856  | 37.4                      |
| 1998                                    | 11,521                       | 609.5                    | 2,669                                   | 13,412                                  | 5.0                                      | 2,823  | 37.9                      |
| 1999                                    | 11,603                       | 626.4                    | 2,813                                   | 14,108                                  | 5.0                                      | 2,785  | 39.3                      |
| 2000                                    | 12,168                       | 648.0                    | 2,952                                   | 15,200                                  | 5.1                                      | 2,797  | 42.5                      |
| 2001                                    | 12,084                       | 662.4                    | 3,064                                   | 15,615                                  | 5.1                                      | 2,803  | 43.8                      |
| 2002                                    | 12,479                       | 681.9                    | 3,025                                   | 15,095                                  | 5.0                                      | 2,872  | 43.3                      |
| 2003                                    | 12,236                       | 694.2                    | 3,005                                   | 15,082                                  | 5.0                                      | 2,837  | 42.8                      |
| 2004                                    | 12,480                       | 709.7                    | 3,098                                   | 15,930                                  | 5.1                                      | 2,750  | 43.8                      |
| 2005                                    | 12,755                       | 715.4                    | 3,189                                   | 16,118                                  | 5.1                                      | 2,783  | 44.9                      |
| 2006                                    | 12,853                       | 726.4                    | 3,334                                   | 16,587                                  | 5.0                                      | 2,707  | 44.9                      |
| 2007                                    | 13,032                       | 741.2                    | 3,879                                   | 18,070                                  | 4.7                                      | 2,577  | 46.6                      |
| 2008                                    | 13,346                       | 762.8                    | 4,001                                   | 18,941                                  | 4.7                                      | 2,521  | 47.8                      |
| 2009                                    | 13,529                       | 775.3                    | 3,955                                   | 19,004                                  | 4.8                                      | 2,516  | 47.8                      |
| <i>Average annual percentage change</i> |                              |                          |   |   |  |  |                           |
| 1970–2009                               | 0.6%                         | 1.5%                     | 1.6%                                    | 1.1%                                    | -0.1% <sup>g</sup>                       | 0.4%   | 1.5%                      |
| 1999–2009                               | 1.5%                         | 2.2%                     | 3.5%                                    | 3.0%                                    | -0.4%                                    | -1.0%  | 2.0%                      |

**Sources:**

American Public Transportation Association, *2011 Public Transportation Fact Book*, Washington, DC, April 2011, Table 27. (Additional resources: [www.apta.com](http://www.apta.com))  
Energy use - See Appendix A for Rail Transit Energy Use.

<sup>a</sup> Heavy rail and light rail. Series not continuous between 1983 and 1984 because of a change in data source by the American Public Transit Association (APTA). Beginning in 1984, data provided by APTA are taken from mandatory reports filed with the Urban Mass Transit Administration (UMTA). Data for prior years were provided on a voluntary basis by APTA members and expanded statistically.

<sup>b</sup> 1970–79 data represents total passenger rides; after 1979, data represents unlinked passenger trips.

<sup>c</sup> Estimated for years 1970–76 based on an average trip length of 5.8 miles.

<sup>d</sup> Calculated as the ratio of passenger-miles to passenger trips.

<sup>e</sup> Large system-to-system variations exist within this category.

<sup>f</sup> Data are not available.

<sup>g</sup> Average annual percentage change is calculated for years 1980–2009.





## Chapter 10

# Transportation and the Economy

Summary Statistics from Tables/Figures in this Chapter

| Source      |  |        |
|-------------|--|--------|
| Figure 10.2 | Share of gasoline cost attributed to taxes, 2010               |        |
|             | <i>Canada</i>  | 35%    |
|             | <i>France</i>  | 62%    |
|             | <i>Germany</i>   | 63%    |
|             | <i>Japan</i>   | 46%    |
|             | <i>United Kingdom</i>  | 64%    |
|             | <i>United States</i>   | 18%    |
| Table 10.12 | Average price of a new car, 2009 (current dollars)             | 23,186 |
|             | <i>Domestic</i>  | 22,107 |
|             | <i>Import</i>  | 25,308 |
| Table 10.13 | Car operating costs, 2010                                      |        |
|             | <i>Variable costs (constant 2010 dollars per 10,000 miles)</i> | 1,673  |
|             | <i>Fixed costs (constant 2010 dollars per 10,000 miles)</i>    | 5,719  |
| Table 10.17 | Transportation sector share of total employment                |        |
|             | <i>2000</i>  | 8.3%   |
|             | <i>2010</i>  | 7.1%   |



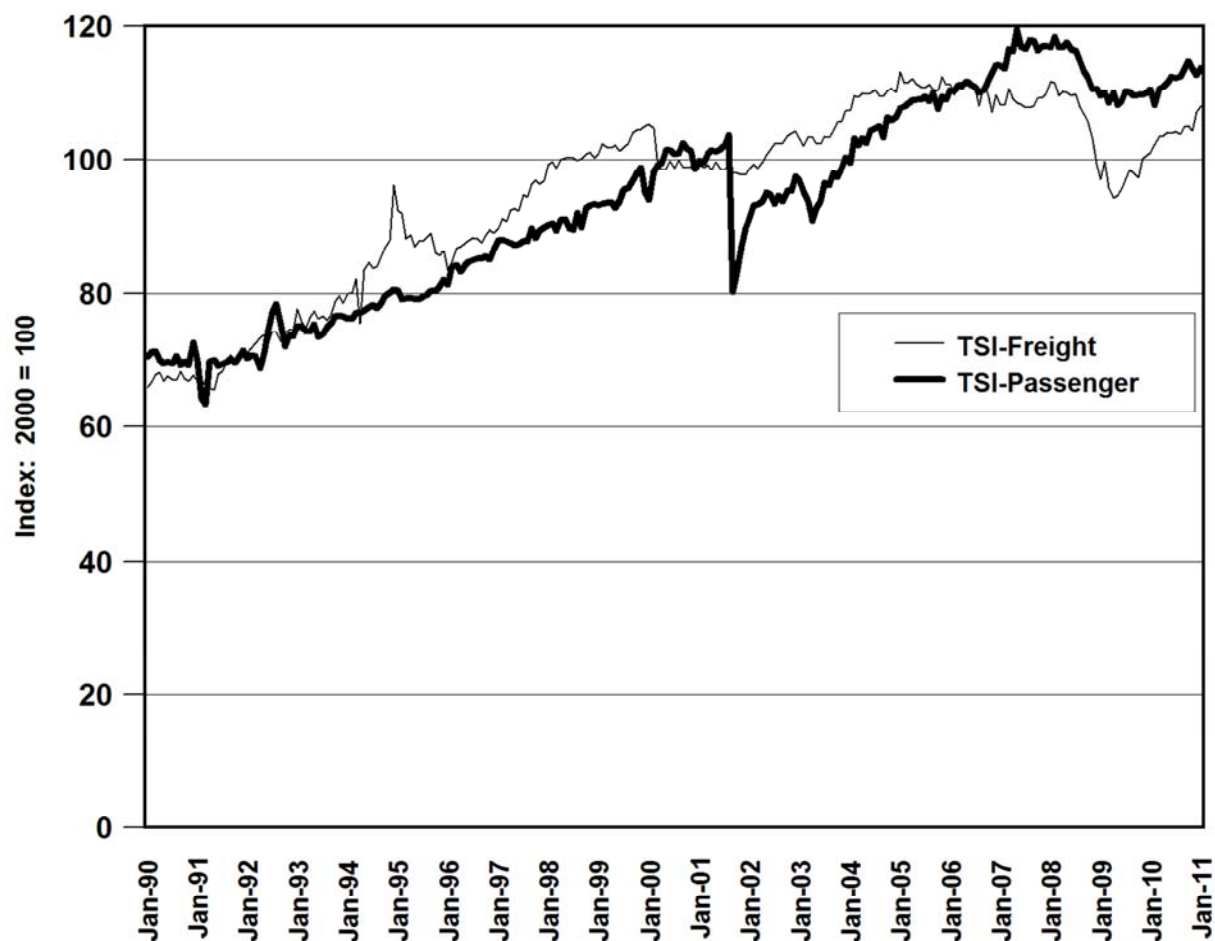
The Transportation Services Index (TSI) was created by the U.S. Department of Transportation Bureau of Transportation Statistics (BTS). It is an index that measures the movement of freight and passengers. The Freight TSI consists of:

- for-hire trucking (parcel services are not included);
- freight railroad services (including rail-based intermodal shipments such as containers on flat cars); inland waterway traffic;
- pipeline movements (including principally petroleum and petroleum products and natural gas);
- and air freight.

The index does not include international or coastal steamship movements, private trucking, courier services, or the United States Postal Services.

The index does not include intercity bus, sightseeing services, taxi service, private automobile usage, or bicycling and other nonmotorized means of transportation.

**Figure 10.1. Transportation Services Index, January 1990–January 2011**



**Source:**

U.S. Department of Transportation, Bureau of Transportation Statistics, Transportation Services Index Web site, [www.bts.gov/xml/tsi/src](http://www.bts.gov/xml/tsi/src). (Additional resources: [www.bts.gov](http://www.bts.gov).)



*Until 2007, gasoline prices in China were, on average, less than the United States. Since then, the United States prices are the lowest of these listed countries. Those in France, the United Kingdom, and Germany paid, on average, more than six dollars per gallon.*

**Table 10.1**  
**Gasoline Prices<sup>a</sup> for Selected Countries, 1990–2010**

|                             | Current dollars per gallon                    |      |              |      |      |      |                   | Average annual percentage change |
|-----------------------------|---|------|--------------|------|------|------|-------------------|----------------------------------|
|                             | 1990  | 1995 | 2000         | 2005 | 2007 | 2009 | 2010 <sup>b</sup> | 1990–2010                        |
| China                       | <sup>c</sup>                                  | 1.03 | <sup>c</sup> | 1.70 | 2.29 | 3.27 | <sup>c</sup>      | <sup>c</sup>                     |
| Japan                       | 3.16  | 4.43 | 3.65         | 4.28 | 4.49 | 4.86 | 5.93              | 3.2%                             |
| France <sup>d</sup>         | 3.63  | 4.26 | 3.80         | 5.46 | 6.60 | 6.35 | 6.72              | 3.1%                             |
| United Kingdom <sup>d</sup> | 2.82  | 3.21 | 4.58         | 5.97 | 7.15 | 5.86 | 6.81              | 4.5%                             |
| Germany                     | 2.65  | 3.96 | 3.45         | 5.66 | 6.88 | 6.81 | 6.86              | 4.9%                             |
| Canada                      | 1.87  | 1.53 | 1.86         | 2.89 | 3.59 | 3.15 | 3.72              | 3.5%                             |
| United States <sup>e</sup>  | 1.16  | 1.15 | 1.51         | 2.27 | 2.80 | 2.34 | 2.72              | 4.3%                             |
|                             | Constant 2010 dollars <sup>f</sup> per gallon |      |              |      |      |      |                   | Average annual percentage change |
|                             | 1990  | 1995 | 2000         | 2005 | 2007 | 2009 | 2010 <sup>b</sup> | 1990–2010                        |
| China                       | <sup>c</sup>                                  | 1.47 | <sup>c</sup> | 1.90 | 2.41 | 3.33 | <sup>c</sup>      | <sup>c</sup>                     |
| Japan                       | 5.27  | 6.34 | 4.62         | 4.78 | 4.73 | 4.94 | 5.93              | 0.6%                             |
| France <sup>d</sup>         | 6.06  | 6.10 | 4.81         | 6.09 | 6.94 | 6.45 | 6.72              | 0.6%                             |
| United Kingdom <sup>d</sup> | 4.70  | 4.59 | 5.80         | 6.66 | 7.52 | 5.96 | 6.81              | 1.9%                             |
| Germany                     | 4.42  | 5.67 | 4.37         | 6.31 | 7.24 | 6.92 | 6.86              | 2.3%                             |
| Canada                      | 3.12  | 2.19 | 2.36         | 3.22 | 3.78 | 3.20 | 3.72              | 0.9%                             |
| United States <sup>e</sup>  | 1.94  | 1.65 | 1.91         | 2.54 | 2.94 | 2.38 | 2.72              | 1.8%                             |

**Source:**

International Energy Agency, *Energy Prices and Taxes, Fourth Quarter, 2010*, Paris, France, 2011. (Additional resources: [www.iea.org](http://www.iea.org))

**Note:** Comparisons between prices and price trends in different countries require care. They are of limited validity because of fluctuations in exchange rates; differences in product quality, marketing practices, and market structures; and the extent to which the standard categories of sales are representative of total national sales for a given period.

<sup>a</sup> Prices represent the retail prices (including taxes) for regular unleaded gasoline, except for France and the United Kingdom which are premium unleaded gasoline.

<sup>b</sup> 3<sup>rd</sup> quarter 2010.

<sup>c</sup> Data are not available.

<sup>d</sup> Premium gasoline.

<sup>e</sup> These estimates are international comparisons only and do not necessarily correspond to gasoline price estimates in other sections of the book.

<sup>f</sup> Adjusted by the U.S. Consumer Price Inflation Index.



*Of these selected countries, the United Kingdom had the highest diesel fuel price average in 2010, while the United States had the lowest. Similar to the trend with gasoline prices, China's diesel prices were lower than the United States until 2007.*

**Table 10.2**  
**Diesel Fuel Prices<sup>a</sup> for Selected Countries, 1998–2010**

|                            | Current dollars per gallon                    |              |      |      |      |      |      |                   | Average annual percentage change |
|----------------------------|---|--------------|------|------|------|------|------|-------------------|----------------------------------|
|                            | 1998  | 2000         | 2003 | 2004 | 2005 | 2007 | 2009 | 2010 <sup>b</sup> | 1998–2010                        |
| China                      | <sup>c</sup>                                  | <sup>c</sup> | 1.32 | 1.47 | 1.69 | 2.42 | 3.23 | <sup>c</sup>      | <sup>c</sup>                     |
| Japan                      | 2.25  | 2.85         | 2.76 | 3.08 | 3.45 | 3.82 | 4.19 | 5.04              | 7.0%                             |
| France                     | 2.71  | 2.95         | 3.39 | 4.16 | 4.81 | 5.66 | 5.27 | 5.59              | 6.2%                             |
| United Kingdom             | 4.10  | 4.66         | 4.82 | 5.68 | 6.25 | 7.34 | 6.14 | 6.95              | 4.5%                             |
| Germany                    | 2.45  | 2.79         | 3.79 | 4.41 | 5.01 | 6.06 | 5.73 | 5.94              | 7.7%                             |
| United States <sup>d</sup> | 1.04  | 1.50         | 1.51 | 1.81 | 2.40 | 2.88 | 2.46 | 2.94              | 9.0%                             |
|                            | Constant 2010 dollars <sup>e</sup> per gallon |              |      |      |      |      |      |                   | Average annual percentage change |
|                            | 1998  | 2000         | 2003 | 2004 | 2005 | 2007 | 2009 | 2010 <sup>b</sup> | 1998–2010                        |
| China                      | <sup>c</sup>                                  | <sup>c</sup> | 1.57 | 1.70 | 1.89 | 2.55 | 3.28 | <sup>c</sup>      | <sup>c</sup>                     |
| Japan                      | 3.01  | 3.61         | 3.27 | 3.56 | 3.85 | 4.02 | 4.26 | 5.04              | 4.4%                             |
| France                     | 3.62  | 3.73         | 4.02 | 4.80 | 5.37 | 5.95 | 5.35 | 5.59              | 3.7%                             |
| United Kingdom             | 5.49  | 5.90         | 5.71 | 6.56 | 6.98 | 7.72 | 6.24 | 6.95              | 2.0%                             |
| Germany                    | 3.28  | 3.54         | 4.49 | 5.09 | 5.59 | 6.37 | 5.83 | 5.94              | 5.1%                             |
| United States <sup>d</sup> | 1.40  | 1.89         | 1.79 | 2.08 | 2.68 | 3.03 | 2.50 | 2.94              | 6.4%                             |

**Source:**

International Energy Agency, *Energy Prices and Taxes, Fourth Quarter, 2010*, Paris, France, 2011 (Additional resources: [www.iea.org](http://www.iea.org))

**Note:** Comparisons between prices and price trends in different countries require care. They are of limited validity because of fluctuations in exchange rates; differences in product quality, marketing practices, and market structures; and the extent to which the standard categories of sales are representative of total national sales for a given period.

<sup>a</sup> Prices represent the retail prices (including taxes) for automotive diesel fuel for non-commercial (household) use.

<sup>b</sup> 3<sup>rd</sup> quarter 2010.

<sup>c</sup> Data are not available.

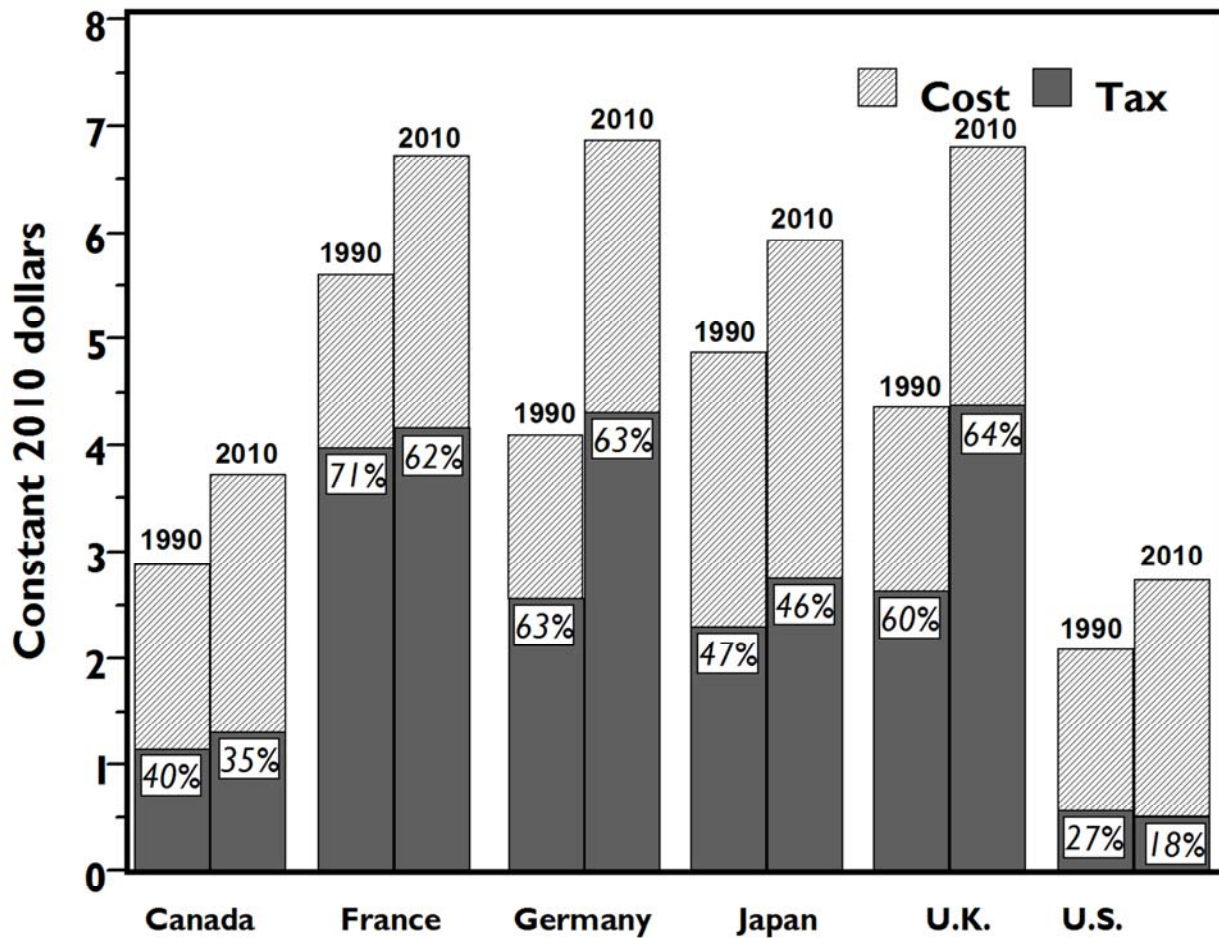
<sup>d</sup> These estimates are for international comparisons only and do not necessarily correspond to gasoline price estimates in other sections of the book.

<sup>e</sup> Adjusted by the U.S. Consumer Price Inflation Index.



*In 2010 more than sixty percent of the cost of gasoline in France, Germany, and the United Kingdom went for taxes. Of the listed countries, the United States has the lowest percentage of taxes.*

**Figure 10.2. Gasoline Prices for Selected Countries, 1990 and 2010**



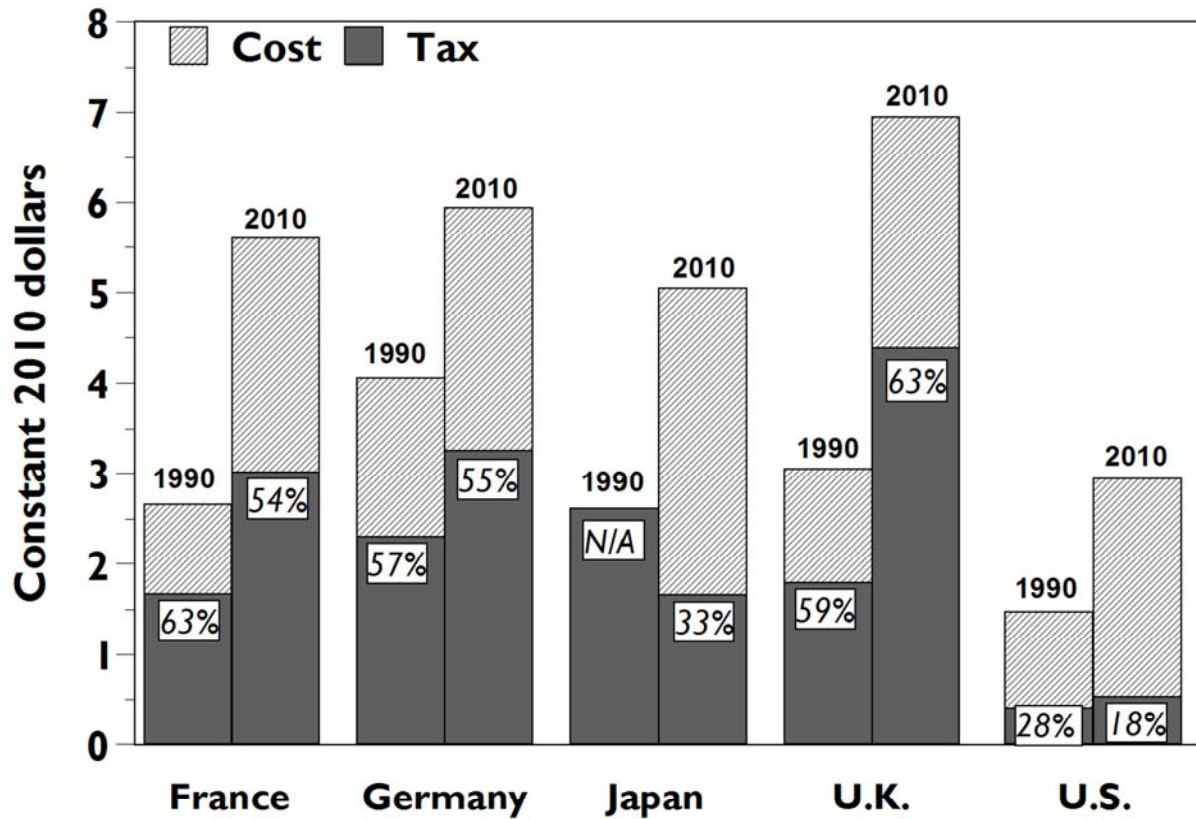
**Source:**

Table 10.1 and International Energy Agency, *Energy Prices & Taxes, Fourth Quarter, 2010*, Paris, France, 2011.  
(Additional resources: [www.iea.org](http://www.iea.org).)



*Diesel fuel is taxed heavily in the European countries shown here. The U.S. diesel fuel tax share is the lowest of the listed countries.*

**Figure 10.3. Diesel Prices for Selected Countries, 1990 and 2010**



**Source:**

Table 10.2 and International Energy Agency, *Energy Prices & Taxes, Fourth Quarter, 2010*, Paris, France, 2011.  
(Additional resources: [www.iea.org](http://www.iea.org).)





*Though the cost of crude oil certainly influences the price of gasoline, it is not the only factor which determines the price at the pump. Processing cost, transportation cost, and taxes also play a major part of the cost of a gallon of gasoline. The average price of a barrel of crude oil (in constant 2010 dollars) increased by 114% from 2000 to 2010, while the average price of a gallon of gasoline increased 43% in this same time period.*

**Table 10.3**  
**Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978–2010**

| Year                                    | Crude oil <sup>a</sup><br>(dollars per barrel) |                            | Gasoline <sup>b</sup><br>(cents per gallon) |                            | Ratio of<br>gasoline to<br>crude oil |
|---|--|----------------------------|---|----------------------------|--------------------------------------|
|   | Current  | Constant 2010 <sup>c</sup> | Current                                     | Constant 2010 <sup>c</sup> |                                      |
| 1978                                    | 12.5   | 41.7                       | 65.2  | 218.1                      | 219.8                                |
| 1979                                    | 17.7   | 53.2                       | 88.2  | 264.9                      | 209.1                                |
| 1980                                    | 28.1   | 74.3                       | 122.1                                       | 323.1                      | 182.7                                |
| 1981                                    | 35.2   | 84.5                       | 135.3                                       | 324.6                      | 161.3                                |
| 1982                                    | 31.9   | 72.0                       | 128.1                                       | 289.5                      | 168.8                                |
| 1983                                    | 29.0   | 63.5                       | 122.5                                       | 268.2                      | 177.5                                |
| 1984                                    | 28.6   | 60.1                       | 119.8                                       | 251.4                      | 175.7                                |
| 1985                                    | 26.8   | 54.2                       | 119.6                                       | 242.4                      | 187.8                                |
| 1986                                    | 14.6   | 28.9                       | 93.1  | 185.2                      | 268.7                                |
| 1987                                    | 17.9   | 34.4                       | 95.7  | 183.7                      | 224.5                                |
| 1988                                    | 14.7   | 27.0                       | 96.3  | 177.5                      | 275.7                                |
| 1989                                    | 18.0   | 31.6                       | 106.0                                       | 186.4                      | 247.7                                |
| 1990                                    | 22.2   | 37.1                       | 121.7                                       | 203.0                      | 230.0                                |
| 1991                                    | 19.1   | 30.5                       | 119.6                                       | 191.5                      | 263.5                                |
| 1992                                    | 18.4   | 28.6                       | 119.0                                       | 185.0                      | 271.2                                |
| 1993                                    | 16.4   | 24.8                       | 117.3                                       | 177.0                      | 300.2                                |
| 1994                                    | 15.6   | 22.9                       | 117.4                                       | 172.7                      | 316.3                                |
| 1995                                    | 17.2   | 24.7                       | 120.5                                       | 172.4                      | 293.7                                |
| 1996                                    | 20.7   | 28.8                       | 128.8                                       | 179.0                      | 261.2                                |
| 1997                                    | 19.0   | 25.9                       | 129.1                                       | 175.4                      | 284.8                                |
| 1998                                    | 12.5   | 16.7                       | 111.5                                       | 149.2                      | 374.0                                |
| 1999                                    | 17.5   | 22.9                       | 122.1                                       | 159.8                      | 292.9                                |
| 2000                                    | 28.3   | 35.8                       | 156.3                                       | 197.9                      | 232.3                                |
| 2001                                    | 23.0   | 28.3                       | 153.1                                       | 188.5                      | 280.2                                |
| 2002                                    | 24.1   | 29.2                       | 144.1                                       | 174.7                      | 251.1                                |
| 2003                                    | 28.5   | 33.8                       | 163.8                                       | 194.1                      | 241.1                                |
| 2004                                    | 37.0   | 42.7                       | 192.3                                       | 222.0                      | 218.4                                |
| 2005                                    | 50.2   | 56.1                       | 233.8                                       | 261.0                      | 195.5                                |
| 2006                                    | 60.2   | 65.2                       | 263.5                                       | 285.0                      | 183.7                                |
| 2007                                    | 67.9   | 71.5                       | 284.9                                       | 299.6                      | 176.1                                |
| 2008                                    | 94.7   | 96.0                       | 331.7                                       | 335.9                      | 147.1                                |
| 2009                                    | 59.3   | 60.2                       | 240.1                                       | 244.0                      | 170.1                                |
| 2010                                    | 76.7   | 76.7                       | 283.6                                       | 283.6                      | 155.3                                |
| <i>Average annual percentage change</i> |  |                            |   |                            |                                      |
| 1978–2010                               | 5.8%   | 1.9%                       | 4.7%  | 0.8%                       |                                      |
| 2000–2010                               | 10.5%  | 7.9%                       | 6.1%  | 3.7%                       |                                      |

**Sources:**

Crude oil - U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2011, Washington, DC, Table 9.1.

Gasoline - U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2011, Washington, DC, Table 9.4. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

<sup>a</sup> Refiner acquisition cost of composite (domestic and imported) crude oil.

<sup>b</sup> Average for all types. These prices were collected from a sample of service stations in 85 urban areas selected to represent all urban consumers. Urban consumers make up about 80% of the total U.S. population.

<sup>c</sup> Adjusted by the Consumer Price Inflation Index.



*Diesel fuel price has generally been lower than gasoline; however, from 2005 through 2010 the price of diesel fuel was higher than that of gasoline.*

**Table 10.4**  
**Retail Prices for Motor Fuel, 1978–2010**  
**(cents per gallon, including tax)**

| Year                                    | Diesel fuel <sup>a</sup> |                            | Average for all gasoline types <sup>b</sup> |                            |
|---|--------------------------|----------------------------|---|----------------------------|
|   | Current <sup>d</sup>     | Constant 2010 <sup>c</sup> | Current                                     | Constant 2010 <sup>c</sup> |
| 1978                                    | d                        | d                          | 65  | 218                        |
| 1979                                    | d                        | d                          | 88  | 265                        |
| 1980                                    | 101                      | 267                        | 122   | 323                        |
| 1981                                    | 118                      | 283                        | 135   | 325                        |
| 1982                                    | 116                      | 262                        | 128   | 289                        |
| 1983                                    | 120                      | 263                        | 123   | 268                        |
| 1984                                    | 122                      | 256                        | 120   | 251                        |
| 1985                                    | 122                      | 247                        | 120   | 242                        |
| 1986                                    | 94                       | 187                        | 93  | 185                        |
| 1987                                    | 96                       | 184                        | 96  | 184                        |
| 1988                                    | 95                       | 175                        | 96  | 178                        |
| 1989                                    | 102                      | 179                        | 106   | 186                        |
| 1990                                    | 107                      | 179                        | 122   | 203                        |
| 1991                                    | 91                       | 146                        | 120   | 191                        |
| 1992                                    | 106                      | 165                        | 119   | 185                        |
| 1993                                    | 98                       | 148                        | 117   | 177                        |
| 1994                                    | 111                      | 164                        | 117   | 173                        |
| 1995                                    | 111                      | 159                        | 121   | 172                        |
| 1996                                    | 124                      | 172                        | 129   | 179                        |
| 1997                                    | 120                      | 163                        | 129   | 175                        |
| 1998                                    | 104                      | 140                        | 112   | 149                        |
| 1999                                    | 112                      | 147                        | 122   | 160                        |
| 2000                                    | 149                      | 189                        | 156   | 198                        |
| 2001                                    | 140                      | 172                        | 153   | 189                        |
| 2002                                    | 132                      | 160                        | 144   | 175                        |
| 2003                                    | 151                      | 179                        | 164   | 194                        |
| 2004                                    | 181                      | 209                        | 192   | 222                        |
| 2005                                    | 240                      | 268                        | 234   | 261                        |
| 2006                                    | 271                      | 293                        | 264   | 285                        |
| 2007                                    | 289                      | 303                        | 285   | 300                        |
| 2008                                    | 380                      | 385                        | 332   | 336                        |
| 2009                                    | 247                      | 251                        | 240   | 244                        |
| 2010                                    | 299                      | 299                        | 284   | 284                        |
| <i>Average annual percentage change</i> |                          |                            |   |                            |
| 1978–2010                               | 3.7% <sup>e</sup>        | -0.4% <sup>e</sup>         | 4.7%  | 0.8%                       |
| 2000–2010                               | 7.2%                     | 4.7%                       | 6.2%  | 3.7%                       |

**Sources:**

Gasoline - U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2011, Washington, DC, Table 9.4.

Diesel - U.S. Department of Energy, Energy Information Administration, *International Energy Annual 2004*, Washington, DC, June 2004, Table 7.2. 2005–2010 data from EIA Web site. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

<sup>a</sup> 1980–1993: Collected from a survey of prices on January 1 of the current year. 1994–on: Annual average.

<sup>b</sup> These prices were collected from a sample of service stations in 85 urban areas selected to represent all urban consumers. Urban consumers make up about 80 percent of the total U.S. population.

<sup>c</sup> Adjusted by the Consumer Price Inflation Index.

<sup>d</sup> Data are not available.

<sup>e</sup> Average annual percentage change is from the earliest year possible to 2010.



*The fuel prices shown here are **refiner sales prices** of transportation fuels to end users, excluding tax. Sales to end users are those made directly to the ultimate consumer, including bulk consumers. Bulk sales to utility, industrial, and commercial accounts previously included in the wholesale category are now counted as sales to end users.*

**Table 10.5**  
**Refiner Sales Prices for Propane and No. 2 Diesel, 1978–2010**  
 (cents per gallon, excluding tax)

| Year                                    | Propane <sup>a</sup> |                            | No 2. diesel fuel |                            |
|---|----------------------|----------------------------|-------------------|----------------------------|
|   | Current              | Constant 2010 <sup>b</sup> | Current           | Constant 2010 <sup>b</sup> |
| 1978                                    | 33.5                 | 112.0                      | 37.7              | 126.1                      |
| 1979                                    | 35.7                 | 107.2                      | 58.5              | 175.7                      |
| 1980                                    | 48.2                 | 127.6                      | 81.8              | 216.5                      |
| 1981                                    | 56.5                 | 135.5                      | 99.5              | 238.7                      |
| 1982                                    | 59.2                 | 133.8                      | 94.2              | 212.9                      |
| 1983                                    | 70.9                 | 155.2                      | 82.6              | 180.8                      |
| 1984                                    | 73.7                 | 154.7                      | 82.3              | 172.7                      |
| 1985                                    | 71.7                 | 145.3                      | 78.9              | 159.9                      |
| 1986                                    | 74.5                 | 148.2                      | 47.8              | 95.1                       |
| 1987                                    | 70.1                 | 134.6                      | 55.1              | 105.8                      |
| 1988                                    | 71.4                 | 131.6                      | 50.0              | 92.2                       |
| 1989                                    | 61.5                 | 108.1                      | 58.5              | 102.9                      |
| 1990                                    | 74.5                 | 124.3                      | 72.5              | 121.0                      |
| 1991                                    | 73.0                 | 116.9                      | 64.8              | 103.7                      |
| 1992                                    | 64.3                 | 99.9                       | 61.9              | 96.2                       |
| 1993                                    | 67.3                 | 101.6                      | 60.2              | 90.8                       |
| 1994                                    | 53.0                 | 78.0                       | 55.4              | 81.5                       |
| 1995                                    | 49.2                 | 70.4                       | 56.0              | 80.1                       |
| 1996                                    | 60.5                 | 84.1                       | 68.1              | 94.6                       |
| 1997                                    | 55.2                 | 75.0                       | 64.2              | 87.2                       |
| 1998                                    | 40.5                 | 54.2                       | 49.4              | 66.1                       |
| 1999                                    | 45.8                 | 59.9                       | 58.4              | 76.4                       |
| 2000                                    | 60.3                 | 76.4                       | 93.5              | 118.4                      |
| 2001                                    | 50.6                 | 62.3                       | 84.2              | 103.7                      |
| 2002                                    | 41.9                 | 50.8                       | 76.2              | 92.4                       |
| 2003                                    | 57.7                 | 68.4                       | 94.4              | 111.9                      |
| 2004                                    | 83.9                 | 96.8                       | 124.3             | 143.5                      |
| 2005                                    | 108.9                | 121.6                      | 178.6             | 199.4                      |
| 2006                                    | 135.8                | 146.9                      | 209.6             | 226.7                      |
| 2007                                    | 148.9                | 156.6                      | 226.7             | 238.7                      |
| 2008                                    | 189.2                | 191.6                      | 315.0             | 319.0                      |
| 2009                                    | 122.0                | 124.0                      | 183.3             | 186.0                      |
| 2010                                    | 148.1                | 148.1                      | 213.4             | 213.4                      |
| <i>Average annual percentage change</i> |                      |                            |                   |                            |
| 1978–2010                               | 4.8%                 | 0.9%                       | 5.6%              | 1.7%                       |
| 2000–2010                               | 9.4%                 | 6.8%                       | 8.6%              | 6.1%                       |

**Source:**

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2011, Washington, DC, Table 9.7. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

<sup>a</sup> Consumer grade.

<sup>b</sup> Adjusted by the Consumer Price Inflation Index.



*Prices of finished aviation gasoline and kerosene-type jet fuel began climbing in 1999 and peaked in 2008. In 2010 the prices showed an increase over 2009.*

**Table 10.6**  
**Refiner Sales Prices for Aviation Gasoline and Jet Fuel, 1978–2010**  
**(cents per gallon, excluding tax)**

| Year                                    | Finished aviation gasoline |                            | Kerosene-type jet fuel |                            |
|---|----------------------------|----------------------------|------------------------|----------------------------|
|   | Current                    | Constant 2010 <sup>a</sup> | Current                | Constant 2010 <sup>a</sup> |
| 1978                                    | 51.6                       | 172.6                      | 38.7                   | 129.4                      |
| 1979                                    | 68.9                       | 206.9                      | 54.7                   | 164.3                      |
| 1980                                    | 108.4                      | 286.9                      | 86.6                   | 229.2                      |
| 1981                                    | 130.3                      | 312.6                      | 102.4                  | 245.6                      |
| 1982                                    | 131.2                      | 296.5                      | 96.3                   | 217.6                      |
| 1983                                    | 125.5                      | 274.8                      | 87.8                   | 192.2                      |
| 1984                                    | 123.4                      | 259.0                      | 84.2                   | 176.7                      |
| 1985                                    | 120.1                      | 243.4                      | 79.6                   | 161.3                      |
| 1986                                    | 101.1                      | 201.1                      | 52.9                   | 105.2                      |
| 1987                                    | 90.7                       | 174.1                      | 54.3                   | 104.2                      |
| 1988                                    | 89.1                       | 164.2                      | 51.3                   | 94.6                       |
| 1989                                    | 99.5                       | 175.0                      | 59.2                   | 104.1                      |
| 1990                                    | 112.0                      | 186.9                      | 76.6                   | 127.8                      |
| 1991                                    | 104.7                      | 167.6                      | 65.2                   | 104.4                      |
| 1992                                    | 102.7                      | 159.6                      | 61.0                   | 94.8                       |
| 1993                                    | 99.0                       | 149.4                      | 58.0                   | 87.5                       |
| 1994                                    | 95.7                       | 140.8                      | 53.4                   | 78.6                       |
| 1995                                    | 100.5                      | 143.8                      | 54.0                   | 77.3                       |
| 1996                                    | 111.6                      | 155.1                      | 65.1                   | 90.5                       |
| 1997                                    | 112.8                      | 153.3                      | 61.3                   | 83.3                       |
| 1998                                    | 97.5                       | 130.4                      | 45.2                   | 60.5                       |
| 1999                                    | 105.9                      | 138.6                      | 54.3                   | 71.1                       |
| 2000                                    | 130.6                      | 165.4                      | 89.9                   | 113.8                      |
| 2001                                    | 132.3                      | 162.9                      | 77.5                   | 95.4                       |
| 2002                                    | 128.8                      | 156.1                      | 72.1                   | 87.4                       |
| 2003                                    | 149.3                      | 176.9                      | 87.2                   | 103.3                      |
| 2004                                    | 181.9                      | 210.0                      | 120.7                  | 139.3                      |
| 2005                                    | 223.1                      | 249.1                      | 173.5                  | 193.7                      |
| 2006                                    | 268.2                      | 290.1                      | 199.8                  | 216.1                      |
| 2007                                    | 284.9                      | 299.6                      | 216.5                  | 227.7                      |
| 2008                                    | 327.3                      | 331.5                      | 305.2                  | 309.1                      |
| 2009                                    | 244.2                      | 248.2                      | 170.4                  | 173.2                      |
| 2010                                    | 302.8                      | 302.8                      | 220.1                  | 220.1                      |
| <i>Average annual percentage change</i> |                            |                            |                        |                            |
| 1978–2010                               | 5.7%                       | 1.8%                       | 5.6%                   | 1.7%                       |
| 2000–2010                               | 8.8%                       | 6.2%                       | 9.4%                   | 6.8%                       |

**Source:**

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2011, Washington, DC, Table 9.7. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

<sup>a</sup> Adjusted by the Consumer Price Inflation Index.



*At the end of 2009, only three states offered tax exemptions to encourage the use of gasohol for transportation purposes. This list is quite short compared to the 30 states which offered gasohol tax exemptions twenty-five years ago.*

**Table 10.7**  
**State Tax Exemptions for Gasohol, 2009**

| State | Exemption<br>(cents/gallon of gasohol) |
|-------|--|
| Idaho | 2.5                                    |
| Iowa  | 2.0                                    |
| Maine | 6.5                                    |

**Source:**

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2009*, October 2010, Washington, DC, Table MF-121T. (Additional resources: [www.fhwa.dot.gov](http://www.fhwa.dot.gov))

**Table 10.8**  
**Federal Excise Taxes on Motor Fuels, 2009**

| Fuel                             | Cents per gallon |
|----------------------------------|------------------|
| Gasoline <sup>a</sup>            | 18.40            |
| Diesel                           | 24.40            |
| Gasohol <sup>b</sup>             | 18.40            |
| Other special fuels <sup>b</sup> | 18.40            |
| CNG                              | 18.30            |
| LNG                              | 24.30            |
| LPG                              | 18.30            |

**Source:**

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2009*, October 2010, Washington, DC, Table FE-21B. (Additional resources: [www.fhwa.dot.gov](http://www.fhwa.dot.gov))

<sup>a</sup> All gasohol blends are taxed at the same rate.

<sup>b</sup> Includes benzol, benzene, naphtha, and other liquids used as a motor fuel.



*These states have laws and incentives for alternative fuels production and/or use.*

**Table 10.9**  
**Federal and State Alternative Fuel Incentives, 2011**

| State             | Biodiesel  | Ethanol    | Natural Gas | Liquefied petroleum gas (LPG) | Electric vehicles (EVs) | Neighborhood electric vehicles (NEVs) | Hydrogen fuel cells | Aftermarket conversions |
|-------------------|------------|------------|-------------|-------------------------------|-------------------------|---------------------------------------|---------------------|-------------------------|
| Federal           | 34         | 29         | 27          | 27                            | 22                      | 2                                     | 27                  | 6                       |
| Alabama           | 7          | 5          | 4           | 4                             | 3                       | 0                                     | 3                   | 0                       |
| Alaska            | 2          | 3          | 4           | 2                             | 2                       | 1                                     | 2                   | 2                       |
| Arizona           | 7          | 6          | 13          | 13                            | 13                      | 1                                     | 11                  | 0                       |
| Arkansas          | 4          | 3          | 6           | 3                             | 2                       | 0                                     | 2                   | 1                       |
| California        | 13         | 10         | 25          | 16                            | 30                      | 3                                     | 22                  | 5                       |
| Colorado          | 8          | 9          | 11          | 8                             | 6                       | 1                                     | 7                   | 3                       |
| Connecticut       | 5          | 4          | 8           | 5                             | 7                       | 0                                     | 7                   | 3                       |
| Delaware          | 3          | 3          | 3           | 5                             | 3                       | 1                                     | 2                   | 0                       |
| Dist. of Columbia | 1          | 2          | 4           | 3                             | 5                       | 0                                     | 3                   | 0                       |
| Florida           | 12         | 13         | 3           | 3                             | 7                       | 1                                     | 7                   | 0                       |
| Georgia           | 6          | 6          | 7           | 3                             | 5                       | 0                                     | 3                   | 2                       |
| Hawaii            | 8          | 10         | 5           | 5                             | 9                       | 1                                     | 6                   | 0                       |
| Idaho             | 4          | 2          | 3           | 3                             | 0                       | 1                                     | 2                   | 0                       |
| Illinois          | 20         | 18         | 10          | 9                             | 10                      | 2                                     | 9                   | 4                       |
| Indiana           | 12         | 17         | 9           | 6                             | 5                       | 1                                     | 5                   | 3                       |
| Iowa              | 13         | 18         | 6           | 5                             | 7                       | 1                                     | 5                   | 1                       |
| Kansas            | 9          | 14         | 5           | 4                             | 1                       | 1                                     | 1                   | 1                       |
| Kentucky          | 8          | 8          | 6           | 4                             | 1                       | 1                                     | 1                   | 0                       |
| Louisiana         | 6          | 10         | 12          | 5                             | 4                       | 1                                     | 1                   | 2                       |
| Maine             | 7          | 7          | 4           | 4                             | 4                       | 1                                     | 3                   | 0                       |
| Maryland          | 2          | 3          | 1           | 1                             | 4                       | 2                                     | 0                   | 0                       |
| Massachusetts     | 5          | 4          | 4           | 2                             | 3                       | 0                                     | 2                   | 0                       |
| Michigan          | 9          | 9          | 4           | 4                             | 6                       | 0                                     | 5                   | 0                       |
| Minnesota         | 9          | 11         | 3           | 2                             | 5                       | 2                                     | 4                   | 0                       |
| Mississippi       | 4          | 4          | 8           | 5                             | 2                       | 0                                     | 2                   | 1                       |
| Missouri          | 8          | 6          | 7           | 6                             | 4                       | 1                                     | 5                   | 0                       |
| Montana           | 8          | 7          | 4           | 4                             | 2                       | 1                                     | 2                   | 1                       |
| Nebraska          | 5          | 6          | 4           | 3                             | 2                       | 0                                     | 2                   | 1                       |
| Nevada            | 6          | 5          | 7           | 7                             | 6                       | 1                                     | 6                   | 0                       |
| New Hampshire     | 7          | 3          | 3           | 3                             | 3                       | 1                                     | 3                   | 0                       |
| New Jersey        | 2          | 2          | 4           | 4                             | 4                       | 1                                     | 2                   | 0                       |
| New Mexico        | 12         | 9          | 7           | 6                             | 7                       | 1                                     | 8                   | 1                       |
| New York          | 9          | 10         | 13          | 8                             | 9                       | 1                                     | 9                   | 0                       |
| North Carolina    | 13         | 11         | 6           | 6                             | 6                       | 0                                     | 5                   | 1                       |
| North Dakota      | 12         | 9          | 3           | 2                             | 0                       | 1                                     | 3                   | 0                       |
| Ohio              | 8          | 9          | 4           | 4                             | 3                       | 0                                     | 4                   | 1                       |
| Oklahoma          | 11         | 12         | 13          | 9                             | 9                       | 1                                     | 8                   | 5                       |
| Oregon            | 11         | 11         | 6           | 5                             | 9                       | 1                                     | 5                   | 2                       |
| Pennsylvania      | 6          | 5          | 5           | 3                             | 3                       | 0                                     | 3                   | 1                       |
| Rhode Island      | 2          | 1          | 2           | 1                             | 2                       | 1                                     | 2                   | 0                       |
| South Carolina    | 11         | 9          | 3           | 4                             | 2                       | 1                                     | 7                   | 0                       |
| South Dakota      | 9          | 9          | 1           | 2                             | 0                       | 0                                     | 0                   | 0                       |
| Tennessee         | 11         | 10         | 5           | 4                             | 4                       | 1                                     | 2                   | 0                       |
| Texas             | 9          | 9          | 14          | 10                            | 8                       | 1                                     | 6                   | 3                       |
| Utah              | 1          | 1          | 12          | 7                             | 7                       | 0                                     | 4                   | 2                       |
| Vermont           | 5          | 5          | 6           | 4                             | 4                       | 1                                     | 4                   | 1                       |
| Virginia          | 15         | 10         | 13          | 9                             | 12                      | 1                                     | 10                  | 3                       |
| Washington        | 18         | 14         | 9           | 8                             | 19                      | 1                                     | 6                   | 4                       |
| West Virginia     | 4          | 4          | 4           | 4                             | 4                       | 1                                     | 4                   | 0                       |
| Wisconsin         | 15         | 12         | 9           | 9                             | 7                       | 1                                     | 8                   | 0                       |
| Wyoming           | 0          | 1          | 1           | 0                             | 0                       | 0                                     | 0                   | 0                       |
| <b>Totals</b>     | <b>436</b> | <b>418</b> | <b>360</b>  | <b>283</b>                    | <b>302</b>              | <b>43</b>                             | <b>260</b>          | <b>60</b>               |

**Source:**

U.S. Department of Energy, Energy Efficiency and Renewable Energy, Alternative Fuels Data Center. Data downloaded April 2011. (Additional resources: [www.eere.energy.gov/afdc/laws/matrix/tech](http://www.eere.energy.gov/afdc/laws/matrix/tech))



**Table 10.10**  
**Federal and State Advanced Technology Incentives, 2011**

| State             | Hybrid Electric Vehicles (HEV) or<br>Plug-in Hybrid Vehicles (PHEVs) | Fuel Economy or<br>Efficiency | Idle Reduction | Other <sup>a</sup> |
|-------------------|--|-------------------------------|----------------|--------------------|
| Federal           | 8  | 13                            | 6              | 9                  |
| Alabama           | 1  | 1                             | 2              | 0                  |
| Alaska            | 0  | 2                             | 0              | 0                  |
| Arizona           | 1  | 0                             | 2              | 2                  |
| Arkansas          | 0  | 1                             | 2              | 0                  |
| California        | 23   | 5                             | 4              | 8                  |
| Colorado          | 2  | 1                             | 3              | 0                  |
| Connecticut       | 6  | 2                             | 3              | 3                  |
| Delaware          | 2  | 2                             | 3              | 0                  |
| Dist. of Columbia | 3  | 2                             | 1              | 1                  |
| Florida           | 3  | 1                             | 2              | 1                  |
| Georgia           | 0  | 1                             | 3              | 1                  |
| Hawaii            | 1  | 1                             | 1              | 0                  |
| Idaho             | 1  | 1                             | 0              | 0                  |
| Illinois          | 6  | 3                             | 3              | 0                  |
| Indiana           | 4  | 1                             | 1              | 0                  |
| Iowa              | 0  | 1                             | 0              | 0                  |
| Kansas            | 0  | 1                             | 1              | 0                  |
| Kentucky          | 1  | 1                             | 0              | 0                  |
| Louisiana         | 2  | 1                             | 0              | 0                  |
| Maine             | 1  | 1                             | 2              | 1                  |
| Maryland          | 3  | 0                             | 1              | 2                  |
| Massachusetts     | 2  | 0                             | 1              | 1                  |
| Michigan          | 7  | 2                             | 1              | 0                  |
| Minnesota         | 2  | 1                             | 2              | 1                  |
| Mississippi       | 1  | 1                             | 0              | 0                  |
| Missouri          | 0  | 0                             | 1              | 0                  |
| Montana           | 0  | 1                             | 0              | 0                  |
| Nebraska          | 0  | 0                             | 1              | 0                  |
| Nevada            | 5  | 0                             | 1              | 0                  |
| New Hampshire     | 2  | 1                             | 3              | 0                  |
| New Jersey        | 3  | 1                             | 1              | 1                  |
| New Mexico        | 2  | 1                             | 1              | 1                  |
| New York          | 4  | 1                             | 3              | 2                  |
| North Carolina    | 3  | 1                             | 3              | 0                  |
| North Dakota      | 0  | 0                             | 0              | 0                  |
| Ohio              | 0  | 0                             | 2              | 0                  |
| Oklahoma          | 3  | 0                             | 1              | 0                  |
| Oregon            | 3  | 3                             | 4              | 5                  |
| Pennsylvania      | 1  | 1                             | 5              | 1                  |
| Rhode Island      | 1  | 1                             | 1              | 3                  |
| South Carolina    | 3  | 0                             | 2              | 0                  |
| South Dakota      | 0  | 0                             | 0              | 0                  |
| Tennessee         | 4  | 2                             | 0              | 0                  |
| Texas             | 6  | 0                             | 4              | 1                  |
| Utah              | 2  | 1                             | 2              | 0                  |
| Vermont           | 3  | 3                             | 2              | 1                  |
| Virginia          | 4  | 3                             | 2              | 1                  |
| Washington        | 6  | 2                             | 3              | 3                  |
| West Virginia     | 1  | 0                             | 2              | 0                  |
| Wisconsin         | 5  | 0                             | 2              | 0                  |
| Wyoming           | 0  | 0                             | 0              | 0                  |
| Totals            | 141  | 68                            | 90             | 49                 |

**Source:**

U.S. Department of Energy, Energy Efficiency and Renewable Energy, Alternative Fuels Data Center. Data downloaded April 2011. (Additional resources: [www.eere.energy.gov/afdc/laws/matrix/tech](http://www.eere.energy.gov/afdc/laws/matrix/tech))

<sup>a</sup> Includes Clean Fuel Initiatives and Pollution Prevention.



*The average price of a new car in 2009 (\$23,186) was very close to the average price in 1916 (\$21,272) when adjusted for inflation. Average new car prices were at their lowest in 1940 (\$11,898). Since 1914 the highest average price was in the year 1998 (\$26,803).*

**Table 10.11**  
**Average Price of a New Car, 1906–2009**

| Year | 2009<br>Constant<br>Dollars | Year | 2009<br>Constant<br>Dollars | Year | 2009<br>Constant<br>Dollars | Year | 2009<br>Constant<br>Dollars |
|------|-----------------------------|------|-----------------------------|------|-----------------------------|------|-----------------------------|
| 1906 | \$36,588                    | 1935 | \$14,783                    | 1961 | \$19,410                    | 1987 | \$25,280                    |
| 1908 | \$32,755                    | 1936 | \$12,980                    | 1962 | \$19,295                    | 1988 | \$25,266                    |
| 1910 | \$27,877                    | 1937 | \$13,340                    | 1963 | \$19,082                    | 1989 | \$24,864                    |
| 1912 | \$28,922                    | 1938 | \$13,701                    | 1964 | \$19,178                    | 1990 | \$24,691                    |
| 1913 | \$31,007                    | 1939 | \$12,800                    | 1965 | \$18,815                    | 1991 | \$24,376                    |
| 1914 | \$32,089                    | 1940 | \$11,898                    | 1966 | \$18,800                    | 1992 | \$24,980                    |
| 1915 | \$26,681                    | 1941 | \$12,052                    | 1967 | \$20,657                    | 1993 | \$25,048                    |
| 1916 | \$21,272                    | 1942 | \$12,207                    | 1968 | \$19,465                    | 1994 | \$25,917                    |
| 1917 | \$19,650                    | 1943 | \$12,361                    | 1969 | \$19,465                    | 1995 | \$25,281                    |
| 1918 | \$18,027                    | 1944 | \$12,515                    | 1970 | \$19,585                    | 1996 | \$25,675                    |
| 1919 | \$17,847                    | 1945 | \$12,620                    | 1971 | \$19,822                    | 1997 | \$25,712                    |
| 1920 | \$17,667                    | 1946 | \$12,824                    | 1972 | \$19,909                    | 1998 | \$26,803                    |
| 1921 | \$18,749                    | 1947 | \$12,978                    | 1973 | \$19,579                    | 1999 | \$26,669                    |
| 1922 | \$19,830                    | 1948 | \$13,592                    | 1974 | \$19,321                    | 2000 | \$25,665                    |
| 1923 | \$18,027                    | 1949 | \$15,839                    | 1975 | \$19,739                    | 2001 | \$26,013                    |
| 1924 | \$16,225                    | 1950 | \$16,232                    | 1976 | \$20,428                    | 2002 | \$25,340                    |
| 1925 | \$16,044                    | 1951 | \$16,508                    | 1977 | \$20,583                    | 2003 | \$25,238                    |
| 1926 | \$15,864                    | 1952 | \$17,882                    | 1978 | \$20,990                    | 2004 | \$24,574                    |
| 1927 | \$15,684                    | 1953 | \$17,904                    | 1979 | \$20,233                    | 2005 | \$25,284                    |
| 1928 | \$15,504                    | 1954 | \$17,579                    | 1980 | \$19,720                    | 2006 | \$25,151                    |
| 1929 | \$15,323                    | 1955 | \$17,483                    | 1981 | \$21,029                    | 2007 | \$24,721                    |
| 1930 | \$15,143                    | 1956 | \$17,987                    | 1982 | \$21,987                    | 2008 | \$23,334                    |
| 1931 | \$16,946                    | 1957 | \$19,982                    | 1983 | \$22,845                    | 2009 | \$23,186                    |
| 1932 | \$18,749                    | 1958 | \$21,138                    | 1984 | \$23,488                    |      |                             |
| 1933 | \$17,667                    | 1959 | \$21,183                    | 1985 | \$23,603                    |      |                             |
| 1934 | \$16,585                    | 1960 | \$20,384                    | 1986 | \$24,766                    |      |                             |

**Sources:**

Compiled by Jacob Ward, Vehicle Technologies Program, U.S. Department of Energy, from the following sources:  
 Raff, D.M.G. & Trajtenberg, M. (1995), "Quality-Adjusted Prices for the American Automobile Industry: 1906-1940," National Bureau of Economic Research, Inc.; Gordon, R.J. (1990), *The Measurement of Durable Goods Prices*, National Bureau of Economic Research, Inc.; and U.S. Department of Commerce, Bureau of Economic Analysis (2010), National Income and Product Accounts.

**Note:** Estimations were used for years 1941-1946.





*In current dollars, import cars, on average, were less expensive than domestic cars until 1982. Since then, import prices have almost tripled, while domestic prices have more than doubled (current dollars).*

**Table 10.12**  
**Average Price of a New Car (Domestic and Import), 1970–2009**

| Year                                    | Domestic <sup>a</sup> |                                    | Import          |                                    | Total           |                                    |
|---|-----------------------|------------------------------------|-----------------|------------------------------------|-----------------|------------------------------------|
|   | Current dollars       | Constant 2009 dollars <sup>b</sup> | Current dollars | Constant 2009 dollars <sup>b</sup> | Current dollars | Constant 2009 dollars <sup>b</sup> |
| 1970                                    | 3,708                 | 20,503                             | 2,648           | 14,642                             | 3,542           | 19,585                             |
| 1975                                    | 5,084                 | 20,273                             | 4,384           | 17,482                             | 4,950           | 19,739                             |
| 1976                                    | 5,506                 | 20,760                             | 4,923           | 18,562                             | 5,418           | 20,428                             |
| 1977                                    | 5,985                 | 21,188                             | 5,072           | 17,956                             | 5,814           | 20,583                             |
| 1978                                    | 6,478                 | 21,316                             | 5,934           | 19,525                             | 6,379           | 20,990                             |
| 1979                                    | 6,889                 | 20,357                             | 6,704           | 19,811                             | 6,847           | 20,233                             |
| 1980                                    | 7,609                 | 19,811                             | 7,482           | 19,480                             | 7,574           | 19,720                             |
| 1981                                    | 8,912                 | 21,034                             | 8,896           | 20,996                             | 8,910           | 21,029                             |
| 1982                                    | 9,865                 | 21,932                             | 9,957           | 22,136                             | 9,890           | 21,987                             |
| 1983                                    | 10,516                | 22,651                             | 10,868          | 23,410                             | 10,606          | 22,845                             |
| 1984                                    | 11,079                | 22,876                             | 12,336          | 25,472                             | 11,375          | 23,488                             |
| 1985                                    | 11,589                | 23,107                             | 12,853          | 25,627                             | 11,838          | 23,603                             |
| 1986                                    | 12,319                | 24,114                             | 13,670          | 26,758                             | 12,652          | 24,766                             |
| 1987                                    | 12,922                | 24,404                             | 14,470          | 27,327                             | 13,386          | 25,280                             |
| 1988                                    | 13,418                | 24,334                             | 15,221          | 27,603                             | 13,932          | 25,266                             |
| 1989                                    | 13,936                | 24,111                             | 15,510          | 26,834                             | 14,371          | 24,864                             |
| 1990                                    | 14,489                | 23,783                             | 16,640          | 27,314                             | 15,042          | 24,691                             |
| 1991                                    | 15,192                | 23,930                             | 16,327          | 25,718                             | 15,475          | 24,376                             |
| 1992                                    | 15,644                | 23,922                             | 18,593          | 28,431                             | 16,336          | 24,980                             |
| 1993                                    | 15,976                | 23,719                             | 20,261          | 30,081                             | 16,871          | 25,048                             |
| 1994                                    | 16,930                | 24,508                             | 21,989          | 31,832                             | 17,903          | 26,917                             |
| 1995                                    | 16,864                | 23,740                             | 23,202          | 32,662                             | 17,959          | 25,281                             |
| 1996                                    | 17,468                | 23,885                             | 26,205          | 35,831                             | 18,777          | 25,675                             |
| 1997                                    | 17,600                | 23,526                             | 27,509          | 36,771                             | 19,236          | 25,712                             |
| 1998                                    | 18,479                | 24,322                             | 29,614          | 38,977                             | 20,364          | 26,803                             |
| 1999                                    | 19,032                | 24,508                             | 27,542          | 35,467                             | 20,710          | 26,669                             |
| 2000                                    | 18,577                | 23,144                             | 27,447          | 34,195                             | 20,600          | 25,665                             |
| 2001                                    | 20,042                | 24,279                             | 25,787          | 31,238                             | 21,474          | 26,013                             |
| 2002                                    | 18,897                | 22,535                             | 27,440          | 32,723                             | 21,249          | 25,340                             |
| 2003                                    | 19,971                | 23,285                             | 26,081          | 30,409                             | 21,646          | 25,238                             |
| 2004                                    | 18,910                | 21,476                             | 28,409          | 32,265                             | 21,646          | 24,584                             |
| 2005                                    | 21,593                | 23,720                             | 26,621          | 29,243                             | 23,017          | 25,284                             |
| 2006                                    | 22,166                | 23,588                             | 27,062          | 28,799                             | 23,634          | 25,151                             |
| 2007                                    | 22,273                | 23,046                             | 27,487          | 28,441                             | 23,892          | 24,721                             |
| 2008                                    | 22,166                | 22,087                             | 25,908          | 25,816                             | 23,417          | 23,334                             |
| 2009                                    | 22,107                | 22,107                             | 25,308          | 25,308                             | 23,186          | 23,186                             |
| <i>Average annual percentage change</i> |                       |                                    |                 |                                    |                 |                                    |
| 1970–2009                               | 4.7%                  | 0.2%                               | 6.0%            | 1.4%                               | 4.9%            | 0.4%                               |
| 1999–2009                               | 1.5%                  | -1.0%                              | -0.8%           | -3.3%                              | 1.1%            | -1.4%                              |

**Source:**

U.S. Department of Commerce, Bureau of Economic Analysis, *National Income and Product Accounts*, underlying detail estimates for Motor Vehicle Output, Washington, DC, 2011. (Additional resources: [www.stat-usa.gov](http://www.stat-usa.gov))

<sup>a</sup> Includes transplants.

<sup>b</sup> Adjusted by the Consumer Price Inflation Index.



*The total cost of operating a car is the sum of the fixed cost (depreciation, insurance, finance charge, and license fee) and the variable cost (gas and oil, tires, and maintenance), which is related to the amount of travel. The gas and oil share of total cost was 15.4% in 2010.*

**Table 10.13**  
**Car Operating Cost per Mile, 1985–2010**

| Model year                              | Constant 2010 dollars per 10,000 miles <sup>a</sup> |            |            | Total cost per mile <sup>b</sup> (constant 2010 cents <sup>a</sup> ) | Percentage gas and oil of total cost |
|---|---|------------|------------|--|--------------------------------------|
|   | Variable cost                                       | Fixed cost | Total cost |  |                                      |
| 1985                                    | 1,504   | 4,177      | 5,680      | 56.80  | 19.9%                                |
| 1986                                    | 1,297   | 4,590      | 5,887      | 58.87  | 15.1%                                |
| 1987                                    | 1,286   | 4,469      | 5,755      | 57.55  | 14.7%                                |
| 1988                                    | 1,456   | 5,585      | 7,041      | 70.41  | 13.6%                                |
| 1989                                    | 1,407   | 5,135      | 6,542      | 65.42  | 14.2%                                |
| 1990                                    | 1,401   | 5,432      | 6,834      | 68.34  | 13.2%                                |
| 1991                                    | 1,553   | 5,709      | 7,262      | 72.62  | 14.6%                                |
| 1992                                    | 1,399   | 5,881      | 7,280      | 72.80  | 12.6%                                |
| 1993                                    | 1,388   | 5,617      | 7,005      | 70.05  | 12.7%                                |
| 1994                                    | 1,339   | 5,644      | 6,983      | 69.83  | 11.8%                                |
| 1995                                    | 1,374   | 5,730      | 7,104      | 71.04  | 11.7%                                |
| 1996                                    | 1,334   | 5,827      | 7,162      | 71.62  | 10.9%                                |
| 1997                                    | 1,467   | 5,907      | 7,375      | 73.75  | 12.2%                                |
| 1998                                    | 1,431   | 6,057      | 7,489      | 74.89  | 11.1%                                |
| 1999                                    | 1,387   | 6,099      | 7,487      | 74.87  | 9.8%                                 |
| 2000                                    | 1,545   | 5,982      | 7,527      | 75.27  | 11.6%                                |
| 2001                                    | 1,675   | 5,690      | 7,364      | 73.64  | 13.2%                                |
| 2002                                    | 1,430   | 5,908      | 7,338      | 73.38  | 9.7%                                 |
| 2003                                    | 1,552   | 5,788      | 7,340      | 73.40  | 11.6%                                |
| 2004                                    | 1,454   | 6,502      | 7,957      | 79.57  | 9.4%                                 |
| 2005                                    | 1,574   | 6,043      | 7,617      | 76.17  | 12.0%                                |
| 2006                                    | 1,633   | 5,069      | 6,702      | 67.02  | 15.3%                                |
| 2007                                    | 1,525   | 5,011      | 6,536      | 65.36  | 14.3%                                |
| 2008                                    | 1,718   | 5,468      | 7,186      | 71.86  | 16.4%                                |
| 2009                                    | 1,567   | 5,617      | 7,184      | 71.84  | 14.3%                                |
| 2010                                    | 1,673   | 5,719      | 7,392      | 73.92  | 15.4%                                |
| <i>Average annual percentage change</i> |   |            |            |  |                                      |
| 1985–2010                               | 0.4%  | 1.3%       | 1.1%       | 1.1%   |                                      |

**Source:**

Ward's Communications, *Motor Vehicle Facts and Figures 2010*, Southfield, Michigan, 2010, p. 68, and annual. Original data from AAA "Your Driving Costs."

<sup>a</sup> Adjusted by the Consumer Price Inflation Index.

<sup>b</sup> Based on 10,000 miles per year.



While the previous table shows costs per mile, this table presents costs per year for fixed costs associated with car operation. For 2010 model year autos, the fixed cost is over \$16 per day.

**Table 10.14**  
**Fixed Car Operating Costs per Year, 1975–2010**  
**(constant 2010 dollars)<sup>a</sup>**

| Model year                              | Insurance <sup>b</sup> | License,<br>registration<br>& taxes | Depreciation | Finance<br>charge | Total | Average<br>fixed cost<br>per day |
|---|------------------------|-------------------------------------|--------------|-------------------|-------|----------------------------------|
| 1975                                    | 1,552                  | 122                                 | 3,133        | <sup>c</sup>      | 4,807 | 13.17                            |
| 1977                                    | 1,834                  | 262                                 | 2,999        | <sup>c</sup>      | 5,094 | 13.95                            |
| 1978                                    | 1,395                  | 243                                 | 2,942        | <sup>c</sup>      | 4,580 | 12.54                            |
| 1979                                    | 1,427                  | 266                                 | 2,784        | <sup>c</sup>      | 5,352 | 14.66                            |
| 1980                                    | 1,297                  | 217                                 | 2,747        | <sup>c</sup>      | 5,380 | 14.74                            |
| 1981                                    | 1,204                  | 208                                 | 3,038        | <sup>c</sup>      | 5,605 | 15.36                            |
| 1982                                    | 998                    | 120                                 | 3,015        | <sup>c</sup>      | 5,331 | 14.61                            |
| 1983                                    | 1,012                  | 209                                 | 2,796        | <sup>c</sup>      | 5,157 | 14.13                            |
| 1984                                    | 1,043                  | 219                                 | 2,492        | <sup>c</sup>      | 4,844 | 13.28                            |
| 1985                                    | 942                    | 223                                 | 2,557        | 1,082             | 4,805 | 13.17                            |
| 1986                                    | 1,013                  | 259                                 | 2,626        | 1,267             | 5,165 | 14.15                            |
| 1987                                    | 1,027                  | 246                                 | 2,868        | 1,010             | 5,150 | 14.11                            |
| 1988                                    | 1,056                  | 256                                 | 3,288        | 1,041             | 5,642 | 15.46                            |
| 1989                                    | 1,134                  | 253                                 | 3,549        | 1,034             | 5,970 | 16.35                            |
| 1990                                    | 1,123                  | 275                                 | 3,932        | 1,134             | 6,465 | 17.72                            |
| 1991                                    | 1,134                  | 269                                 | 4,009        | 426               | 5,837 | 15.99                            |
| 1992                                    | 1,223                  | 270                                 | 4,223        | 1,237             | 6,954 | 19.05                            |
| 1993                                    | 1,123                  | 269                                 | 4,271        | 1,011             | 6,673 | 18.29                            |
| 1994                                    | 1,131                  | 285                                 | 4,326        | 953               | 6,696 | 18.35                            |
| 1995                                    | 1,120                  | 290                                 | 4,397        | 982               | 6,789 | 18.60                            |
| 1996                                    | 1,174                  | 299                                 | 4,406        | 998               | 6,877 | 18.85                            |
| 1997                                    | 1,151                  | 283                                 | 4,445        | 1,043             | 6,933 | 18.99                            |
| 1998                                    | 1,204                  | 302                                 | 4,500        | 1,088             | 7,094 | 19.44                            |
| 1999                                    | 1,270                  | 296                                 | 4,497        | 1,084             | 7,146 | 19.58                            |
| 2000                                    | 1,228                  | 282                                 | 4,422        | 1,075             | 7,008 | 19.20                            |
| 2001                                    | 1,220                  | 256                                 | 4,369        | 1,066             | 6,911 | 18.94                            |
| 2002                                    | 1,229                  | 244                                 | 4,510        | 1,004             | 6,987 | 19.14                            |
| 2003                                    | 1,306                  | 243                                 | 4,430        | 882               | 6,860 | 18.80                            |
| 2004                                    | 1,850                  | 479                                 | 4,366        | 855               | 7,551 | 20.69                            |
| 2005                                    | 1,438                  | 434                                 | 4,331        | 825               | 7,028 | 19.26                            |
| 2006                                    | 1,002                  | 579                                 | 3,669        | 774               | 6,024 | 16.51                            |
| 2007                                    | 1,036                  | 566                                 | 3,567        | 771               | 5,940 | 16.27                            |
| 2008                                    | 955                    | 561                                 | 3,363        | 768               | 5,647 | 15.48                            |
| 2009                                    | 992                    | 576                                 | 3,518        | 792               | 5,878 | 16.10                            |
| 2010                                    | 1,031                  | 585                                 | 3,554        | 806               | 5,976 | 16.37                            |
| <i>Average annual percentage change</i> |                        |                                     |              |                   |       |                                  |
| 1975–2010                               | -1.2%                  | 4.6%                                | 0.4%         | <sup>c</sup>      | 0.6%  | 0.6%                             |
| 2000–2010                               | -1.7%                  | 7.6%                                | -2.2%        | -2.8%             | -1.6% | -1.6%                            |

**Source:**

Ward's Communications, *Motor Vehicle Facts and Figures 2010*, Southfield, Michigan, 2010, p. 68 and annual. Original data from AAA "Your Driving Costs."

<sup>a</sup> Adjusted by the Consumer Price Inflation Index.

<sup>b</sup> Fire & Theft: \$50 deductible 1975 through 1977; \$100 deductible 1978 through 1992; \$250 deductible for 1993 – on. Collision: \$100 deductible through 1977; \$250 deductible 1978 through 1992; \$500 deductible for 1993 – on. Property Damage & Liability: coverage = \$100,000/\$300,000.

<sup>c</sup> Data are not available.



**Table 10.15**  
**Personal Consumption Expenditures, 1970–2010**  
**(billion dollars)**

| Year | Personal consumption expenditures |                            | Transportation personal consumption expenditures |                            | Transportation PCE as a percent of PCE |
|------|-----------------------------------|----------------------------|--|----------------------------|--|
|      | Current                           | Constant 2010 <sup>a</sup> | Current  | Constant 2010 <sup>a</sup> |  |
| 1970 | 648.3                             | 2,952.3                    | 80.8   | 368.0                      | 12.5%                                  |
| 1980 | 1,755.8                           | 4,070.7                    | 241.7  | 560.4                      | 13.8%                                  |
| 1990 | 3,835.5                           | 5,878.4                    | 455.7  | 698.4                      | 11.9%                                  |
| 2000 | 6,830.4                           | 8,526.3                    | 814.3  | 1,016.5                    | 11.9%                                  |
| 2001 | 7,148.8                           | 8,726.5                    | 829.6  | 1,012.7                    | 11.6%                                  |
| 2002 | 7,439.2                           | 8,936.6                    | 832.6  | 1,000.2                    | 11.2%                                  |
| 2003 | 7,804.0                           | 9,177.3                    | 874.2  | 1,028.0                    | 11.2%                                  |
| 2004 | 8,285.1                           | 9,474.1                    | 927.8  | 1,060.9                    | 11.2%                                  |
| 2005 | 8,819.0                           | 9,758.6                    | 1,000.3  | 1,106.9                    | 11.3%                                  |
| 2006 | 9,322.7                           | 9,990.3                    | 1,031.0  | 1,104.8                    | 11.1%                                  |
| 2007 | 9,806.3                           | 10,208.0                   | 1,076.2  | 1,120.3                    | 11.0%                                  |
| 2008 | 10,104.5                          | 10,293.1                   | 1,061.5  | 1,081.3                    | 10.5%                                  |
| 2009 | 10,001.3                          | 10,096.7                   | 913.5  | 922.2                      | 9.1%                                   |
| 2010 | 10,349.1                          | 10,349.1                   | 1,002.9  | 1,002.9                    | 9.7%                                   |

**Source:**

U.S. Department of Commerce, Bureau of Economic Analysis, National Income and Product Accounts, Table 2.3.5, <http://www.bea.doc.gov/bea/dn/nipaweb>.

**Note:** Transportation PCE includes the following categories: transportation, motor vehicles and parts, and gasoline and oil.

**Table 10.16**  
**Consumer Price Indices, 1970–2010**  
**(1970 = 1.000)**

| Year | Consumer Price Index | Transportation Consumer Price Index <sup>b</sup> | New car Consumer Price Index | Used car Consumer Price Index | Gross National Product Index |
|------|----------------------|--|------------------------------|-------------------------------|------------------------------|
| 1970 | 1.000                | 1.000  | 1.000                        | 1.000                         | 1.000                        |
| 1980 | 2.124                | 2.216  | 1.667                        | 1.997                         | 2.702                        |
| 1990 | 3.369                | 3.213  | 2.286                        | 3.769                         | 5.585                        |
| 2000 | 4.438                | 4.088  | 2.689                        | 4.994                         | 9.562                        |
| 2005 | 5.034                | 4.637  | 2.597                        | 4.468                         | 12.191                       |
| 2006 | 5.196                | 4.824  | 2.591                        | 4.487                         | 12.895                       |
| 2007 | 5.344                | 4.925  | 2.566                        | 4.351                         | 13.578                       |
| 2008 | 5.549                | 5.215  | 2.527                        | 4.293                         | 13.921                       |
| 2009 | 5.529                | 4.780  | 2.554                        | 4.070                         | 13.655                       |
| 2010 | 5.620                | 5.157  | 2.599                        | 4.587                         | 14.213                       |

**Sources:**

Bureau of Labor Statistics, Consumer Price Index Table 1A for 2010, and annual.

(Additional resources: [www.bls.gov](http://www.bls.gov))

GNP – U.S. Department of Commerce, Bureau of Economic Analysis, National Income and Product Accounts, Table 1.7.5. (Additional resources: [www.bea.doc.gov](http://www.bea.doc.gov))

<sup>a</sup> Adjusted by the GNP price deflator.

<sup>b</sup> Transportation Consumer Price Index includes new and used cars, gasoline, auto insurance rates, intracity mass transit, intracity bus fare, and airline fares.



The data below were summarized from the Bureau of Labor Statistics (BLS) Current Employment Statistics Survey data using the North American Industry Classification System (NAICS). Transportation-related employment was 7.1% of total employment in 2010.

**Table 10.17**  
**Transportation-related Employment, 2000 and 2010<sup>a</sup>**  
(thousands)

|  | 2000            | 2010           | Percent Change |
|--|-----------------|----------------|----------------|
| Truck transportation (includes drivers)                            | 1,405.8         | 1,244.1        | -11.5%         |
| Transit and ground transportation                                  | 372.1           | 432.4          | 16.2%          |
| Air transportation   | 614.4           | 464.2          | -24.4%         |
| Rail transportation  | 231.7           | 214.9          | -7.3%          |
| Water transportation   | 56.0            | 62.8           | 12.1%          |
| Pipeline transportation  | 46.0            | 42.4           | -7.8%          |
| Motor vehicle and parts - retail                                   | 1,846.9         | 1,624.5        | -12.0%         |
| Motor vehicles and parts - wholesale                               | 355.7           | 309.4          | -13.0%         |
| Gasoline stations - retail   | 935.7           | 816.4          | -12.7%         |
| Automotive repair and maintenance                                  | 888.1           | 799.6          | -10.0%         |
| Automotive equipment rental and leasing                            | 208.3           | 162.6          | -21.9%         |
| Manufacturing  | 2,143.9         | 1,382.0        | -35.5%         |
| <i>Autos and light trucks</i>                                      | 237.4           | 127.5          | -46.3%         |
| <i>Heavy-duty trucks</i>   | 54.0            | 23.8           | -55.9%         |
| <i>Motor vehicle bodies and trailers</i>                           | 182.7           | 107.6          | -41.1%         |
| <i>Motor vehicle parts</i>   | 839.5           | 415.1          | -50.6%         |
| <i>Aerospace products and parts</i>                                | 516.7           | 477.1          | -7.7%          |
| <i>Railroad rolling stock &amp; other transportation equipment</i> | 72.7            | 53.3           | -26.7%         |
| <i>Ship &amp; boat building</i>                                    | 154.1           | 125.5          | -18.6%         |
| <i>Tires</i>   | 86.8            | 52.1           | -40.0%         |
| Oil and gas pipeline construction                                  | 72.2            | 94.2           | 30.5%          |
| Highway street and bridge construction                             | 340.1           | 289.0          | -15.0%         |
| Scenic & sightseeing   | 27.5            | 27.3           | -0.7%          |
| Support activities for transportation                              | 537.4           | 540.1          | 0.5%           |
| Couriers and messengers  | 605.0           | 527.1          | -12.9%         |
| Travel arrangement and reservation services                        | 298.6           | 186.6          | -37.5%         |
| <b>Total transportation-related employment</b>                     | <b>10,985.4</b> | <b>9,219.6</b> | <b>-16.1%</b>  |
| Total nonfarm employment   | 131,785.0       | 129,818.0      | -1.5%          |
| Transportation-related to total employment                         | 8.3%            | 7.1%           |                |

**Source:**

Bureau of Labor Statistics Web site query system: [www.bls.gov/ces/cesnaics.htm](http://www.bls.gov/ces/cesnaics.htm), (Additional resources: [www.bls.gov](http://www.bls.gov))

<sup>a</sup> Not seasonally adjusted.



*The total number of employees involved in the manufacture of motor vehicles decreased by almost 56% from 1990 to 2010 and by about 64% for those involved in the manufacture of motor vehicle parts. Beginning in 2008, the share of production workers fell below 80% for manufacturers of both vehicles and parts.*

**Table 10.18**  
**U.S. Employment for Motor Vehicles and Motor Vehicle Parts Manufacturing, 1990–2010<sup>a</sup>**

| Year                | All Employees | Production Workers | Share of Production Workers<br>to Total Employees |
|---------------------|---------------|--------------------|---|
| Motor Vehicles      |               |                    |   |
| 1990                | 271.4         | 243.4              | 89.68%  |
| 1991                | 258.4         | 234.8              | 90.87%  |
| 1992                | 259.9         | 234.0              | 90.03%  |
| 1993                | 263.7         | 234.8              | 89.04%  |
| 1994                | 281.5         | 250.9              | 89.13%  |
| 1995                | 294.7         | 273.7              | 92.87%  |
| 1996                | 285.3         | 271.2              | 95.06%  |
| 1997                | 286.8         | 273.6              | 95.40%  |
| 1998                | 283.6         | 254.8              | 89.84%  |
| 1999                | 291.3         | 254.3              | 87.30%  |
| 2000                | 291.4         | 251.0              | 86.14%  |
| 2001                | 278.7         | 236.4              | 84.82%  |
| 2002                | 265.4         | 220.8              | 83.20%  |
| 2003                | 264.6         | 217.1              | 82.05%  |
| 2004                | 255.9         | 208.0              | 81.28%  |
| 2005                | 247.6         | 198.6              | 80.21%  |
| 2006                | 236.5         | 191.8              | 81.10%  |
| 2007                | 220.0         | 177.3              | 80.59%  |
| 2008                | 191.6         | 151.1              | 78.86%  |
| 2009                | 146.4         | 114.2              | 78.01%  |
| 2010                | 151.3         | 119.7              | 79.11%  |
| Motor Vehicle Parts |               |                    |   |
| 1990                | 653.0         | 527.4              | 80.77%  |
| 1991                | 638.9         | 514.7              | 80.56%  |
| 1992                | 661.2         | 537.0              | 81.22%  |
| 1993                | 677.8         | 554.7              | 81.84%  |
| 1994                | 735.6         | 606.9              | 82.50%  |
| 1995                | 786.9         | 647.7              | 82.31%  |
| 1996                | 799.9         | 657.4              | 82.19%  |
| 1997                | 808.9         | 662.4              | 81.89%  |
| 1998                | 818.2         | 660.3              | 80.70%  |
| 1999                | 837.1         | 674.2              | 80.54%  |
| 2000                | 839.5         | 676.7              | 80.61%  |
| 2001                | 774.7         | 624.9              | 80.66%  |
| 2002                | 733.6         | 590.9              | 80.55%  |
| 2003                | 707.8         | 567.6              | 80.19%  |
| 2004                | 692.1         | 561.6              | 81.14%  |
| 2005                | 678.1         | 553.9              | 81.68%  |
| 2006                | 654.7         | 533.7              | 81.52%  |
| 2007                | 607.9         | 488.9              | 80.42%  |
| 2008                | 543.7         | 430.6              | 79.20%  |
| 2009                | 413.7         | 317.8              | 76.82%  |
| 2010                | 415.1         | 320.4              | 77.19%  |

**Source:**

Tabulated from the U.S. Department of Labor, Bureau of Labor Statistics, [www.bls.gov](http://www.bls.gov), March 2010.

<sup>a</sup> Not seasonally adjusted.



## Chapter 11

# Greenhouse Gas Emissions

Summary Statistics from Tables/Figures in this Chapter

| Source      |  |       |       |
|-------------|--|-------|-------|
| Table 11.1  | Carbon dioxide emissions (million metric tonnes)                                   | 1990  | 2007  |
|             | <i>United States</i>   | 4,989 | 5,986 |
|             | <i>OECD Europe</i>   | 4,149 | 4,386 |
|             | <i>China</i>   | 2,293 | 6,284 |
|             | <i>Russia</i>  | 2,393 | 1,663 |
|             | <i>Japan</i>   | 1,054 | 1,262 |
|             | <i>Non-OECD Europe</i>   | 1,853 | 1,233 |
|             | <i>India</i>   | 573   | 1,399 |
| Table 11.5  | Transportation share of U.S. carbon dioxide emissions from fossil fuel consumption |       |       |
|             | <i>1990</i>  |       | 31.5% |
|             | <i>1995</i>  |       | 31.6% |
|             | <i>2000</i>  |       | 31.9% |
|             | <i>2009</i>  |       | 34.2% |
| Table 11.6  | Motor gasoline share of transportation carbon dioxide emissions                    |       | 61.3% |
| Table 11.10 | Average annual carbon footprint (short tons of CO <sub>2</sub> )                   |       |       |
|             | <i>Cars</i>  |       | 5.7   |
|             | <i>Light trucks</i>  |       | 7.9   |



*The U. S. accounted for 23.2% of the World's carbon dioxide emissions in 1990 and 20.2% in 2007. Nearly half (43%) of the U.S. carbon emissions are from oil use.*

**Table 11.1**  
**World Carbon Dioxide Emissions, 1990 and 2007**

|                              | 1990                |                                   | 2007                |                                   |
|------------------------------|---------------------|-----------------------------------|---------------------|-----------------------------------|
|                              | Million metric tons | Percent of emissions from oil use | Million metric tons | Percent of emissions from oil use |
| United States                | 4,989               | 44%                               | 5,986               | 43%                               |
| Canada                       | 471                 | 48%                               | 586                 | 49%                               |
| Mexico                       | 302                 | 77%                               | 444                 | 61%                               |
| OECD <sup>a</sup> Europe     | 4,149               | 45%                               | 4,386               | 47%                               |
| OECD <sup>a</sup> Asia       | 243                 | 59%                               | 516                 | 44%                               |
| Japan                        | 1,054               | 65%                               | 1,262               | 48%                               |
| Australia/New Zealand        | 298                 | 38%                               | 495                 | 30%                               |
| Russia                       | 2,393               | 33%                               | 1,663               | 22%                               |
| Non-OECD <sup>a</sup> Europe | 1,853               | 32%                               | 1,233               | 26%                               |
| China                        | 2,293               | 15%                               | 6,284               | 15%                               |
| India                        | 573                 | 28%                               | 1,399               | 26%                               |
| Non-OECD <sup>a</sup> Asia   | 811                 | 57%                               | 1,743               | 51%                               |
| Middle East                  | 704                 | 70%                               | 1,515               | 58%                               |
| Africa                       | 659                 | 46%                               | 1,011               | 44%                               |
| Central & South America      | 695                 | 76%                               | 1,169               | 70%                               |
| Total World                  | 21,488              | 42%                               | 29,694              | 38%                               |

**Source:**

U.S. Department of Energy, Energy Information Administration, *International Energy Outlook 2010*, Washington, DC, July 2010, Tables A10 and A11. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

<sup>a</sup> OECD is the Organization for Economic Cooperation and Development. See Glossary for included countries.





*Global Warming Potentials (GWP) were developed to allow comparison of the ability of each greenhouse gas to trap heat in the atmosphere relative to carbon dioxide. Extensive research has been performed and it has been discovered that the effects of various gases on global warming are too complex to be precisely summarized by a single number. Further understanding of the subject also causes frequent changes to estimates. Despite that, the scientific community has developed approximations, the latest of which are shown below. Most analysts use the 100-year time horizon.*

**Table 11.2**  
**Numerical Estimates of Global Warming Potentials Compared with Carbon Dioxide**  
**(kilogram of gas per kilogram of carbon dioxide)**

| Gas   | Lifetime<br>(years) | Global warming potential<br>direct effect for time horizons of |           |           |
|---|---------------------|--|-----------|-----------|
|   |                     | 20 years   | 100 years | 500 years |
| Carbon Dioxide (CO <sub>2</sub> )                               | 5-200 <sup>a</sup>  | 1  | 1         | 1         |
| Methane (CH <sub>4</sub> )                                      | 12                  | 72   | 25        | 8         |
| Nitrous Oxide (N <sub>2</sub> O)                                | 114                 | 289  | 298       | 153       |
| HFCs <sup>b</sup> , PFCs <sup>c</sup> , and Sulfur Hexafluoride |                     |  |           |           |
| HFC-23  | 270                 | 12,000   | 14,800    | 12,200    |
| HFC-125   | 29                  | 6,350  | 3,500     | 1,100     |
| HFC-134a  | 14                  | 3,830  | 1,430     | 435       |
| HFC-152a  | 1                   | 437  | 124       | 38        |
| HFC-227ea   | 34                  | 5,310  | 3,220     | 1,040     |
| Perfluoromethane (CF <sub>4</sub> )                             | 50,000              | 5,210  | 7,390     | 11,200    |
| Perfluoroethane (C <sub>2</sub> F <sub>6</sub> )                | 10,000              | 8,630  | 12,200    | 18,200    |
| Sulfur hexafluoride (SF <sub>6</sub> )                          | 3,200               | 16,300   | 22,800    | 32,600    |

**Source:**

Solomon, S. et al., "Technical Summary," in *Climate Change 2007: The Physical Science Basis*, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2007.

**Note:** The typical uncertainty for global warming potentials is estimated by the Intergovernmental Panel on Climate Change  $\pm$  35 percent.

<sup>a</sup> No single lifetime can be defined for carbon dioxide due to different rates of uptake by different removal processes.

<sup>b</sup> Hydrofluorocarbons

<sup>c</sup> Perfluorocarbons



*Carbon dioxide emissions in 2009 were 8% higher than in 1990. Carbon dioxide accounts for the majority of greenhouse gases.*

**Table 11.3**  
**U.S. Emissions of Greenhouse Gases, based on Global Warming Potential, 1990–2009**  
**(million metric tonnes carbon dioxide equivalent<sup>a</sup>)**

|      | Carbon Dioxide | Methane | Nitrous Oxide | High GWP Gases <sup>b</sup> | Total   |
|------|----------------|---------|---------------|-----------------------------|---------|
| 1990 | 5,040.9        | 768.8   | 221.4         | 102.1                       | 6,133.2 |
| 1991 | 4,997.2        | 769.6   | 223.1         | 92.9                        | 6,082.8 |
| 1992 | 5,106.2        | 772.4   | 227.8         | 97.5                        | 6,203.9 |
| 1993 | 5,216.7        | 744.2   | 229.3         | 97.1                        | 6,287.3 |
| 1994 | 5,297.3        | 745.4   | 240.9         | 100.0                       | 6,383.6 |
| 1995 | 5,353.4        | 732.7   | 236.2         | 119.4                       | 6,441.7 |
| 1996 | 5,539.8        | 721.7   | 237.6         | 130.4                       | 6,629.6 |
| 1997 | 5,607.5        | 706.4   | 224.1         | 138.1                       | 6,676.1 |
| 1998 | 5,643.6        | 688.5   | 221.6         | 154.2                       | 6,707.8 |
| 1999 | 5,709.1        | 669.0   | 220.0         | 151.8                       | 6,750.0 |
| 2000 | 5,900.3        | 663.1   | 217.8         | 154.0                       | 6,935.3 |
| 2001 | 5,807.7        | 649.3   | 210.9         | 141.5                       | 6,809.4 |
| 2002 | 5,866.8        | 650.9   | 210.5         | 151.8                       | 6,880.0 |
| 2003 | 5,923.3        | 660.6   | 211.8         | 145.4                       | 6,941.1 |
| 2004 | 6,031.3        | 661.6   | 222.0         | 157.0                       | 7,071.9 |
| 2005 | 6,055.2        | 669.2   | 223.6         | 161.3                       | 7,109.4 |
| 2006 | 5,961.6        | 678.5   | 223.7         | 163.6                       | 7,027.4 |
| 2007 | 6,059.5        | 690.9   | 228.6         | 171.4                       | 7,150.4 |
| 2008 | 5,865.5        | 724.2   | 223.5         | 169.9                       | 6,983.1 |
| 2009 | 5,446.8        | 730.9   | 219.6         | 178.2                       | 6,575.5 |

**Source:**

U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States, 2009*, Washington, DC, March 31, 2011, Table 1. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

**Note:** This greenhouse gas emissions inventory includes two “adjustments to energy consumption” which make the data different from Table 11.5. The adjustments are as follows:

- (1) Emissions from U.S. Territories are included.
- (2) International bunker fuels and military bunker fuels are excluded from the U.S. total.

<sup>a</sup> Carbon dioxide equivalents are computed by multiplying the weight of the gas being measured by its estimated Global Warming Potential (See Table 11.2).

<sup>b</sup> GWP = Global warming potential. Includes HFC-hydrofluorocarbons; PFC-perfluorocarbons; and SF<sub>6</sub>-sulfur hexafluoride.



*Though the transportation sector accounts for the largest share of carbon dioxide emissions, the industrial sector accounts for the largest share of total greenhouse gas emissions.*

**Table 11.4**  
**Total U.S. Greenhouse Emissions by End-Use Sector, 2009**  
**(million metric tonnes carbon dioxide equivalent<sup>a</sup>)**

| Greenhouse gas and source  | Residential | Commercial | Industrial | Transportation | Transportation<br>Share of Total | Total   |
|--|-------------|------------|------------|----------------|----------------------------------|---------|
| Carbon dioxide   | 1,172.3     | 1,012.3    | 1,505.0    | 1,757.3        | 32.3%                            | 5,446.8 |
| Methane  | 4.7         | 198.8      | 524.7      | 2.7            | 0.4%                             | 730.9   |
| Nitrous oxide  | 4.4         | 8.4        | 177.9      | 28.9           | 13.2%                            | 219.6   |
| Hydrofluorocarbons   | 0.0         | 56.3       | 17.6       | 72.4           | 49.5%                            | 146.3   |
| Perfluorocarbons   | 0.0         | 0.0        | 8.6        | 0.0            | 0.0%                             | 8.6     |
| Other hydrofluorocarbons,<br>perfluorocarbons/perfluoropolyether | 0.0         | 7.9        | 0.0        | 0.0            | 0.0%                             | 7.9     |
| Sulfur hexafluoride  | 4.8         | 4.9        | 6.1        | 0.0            | 0.0%                             | 15.4    |
| Total greenhouse gas emissions                                   | 1,186.2     | 1,288.3    | 2,239.9    | 1,861.2        | 28.3%                            | 6,575.5 |

**Source:**

U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States, 2009*, Washington, DC, March 31, 2011, and annual. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

**Note:** This greenhouse gas emissions inventory includes two “adjustments to energy consumption” which make the data different from Table 11.5. The adjustments are as follows:

- (1) Emissions from U.S. Territories are included.
- (2) International bunker fuels and military bunker fuels are excluded from the U.S. total.

<sup>a</sup> Carbon dioxide equivalents are computed by multiplying the weight of the gas being measured by its estimated Global Warming Potential (See Table 11.2).



*Gases which contain carbon can be measured in terms of the full molecular weight of the gas or just in terms of their carbon content. This table presents carbon dioxide gas. The ratio of the weight of carbon to carbon dioxide is 0.2727. The transportation sector accounts for approximately one-third of carbon emissions.*

**Table 11.5**  
**U.S. Carbon Emissions from Fossil Energy Consumption**  
**by End-Use Sector, 1990–2009<sup>a</sup>**  
**(million metric tonnes of carbon dioxide)**

|   | End Use Sector |            |            |                | Transportation<br>Percentage | CO <sub>2</sub> From<br>All Sectors |
|---|----------------|------------|------------|----------------|------------------------------|-------------------------------------|
|   | Residential    | Commercial | Industrial | Transportation |                              |                                     |
| 1990                                    | 963.4          | 792.6      | 1,695.1    | 1,587.7        | 31.5%                        | 5,038.7                             |
| 1991                                    | 980.1          | 794.3      | 1,653.4    | 1,567.9        | 31.4%                        | 4,995.7                             |
| 1992                                    | 981.4          | 795.9      | 1,724.0    | 1,591.6        | 31.3%                        | 5,092.9                             |
| 1993                                    | 1,039.6        | 819.4      | 1,715.0    | 1,611.2        | 31.1%                        | 5,185.1                             |
| 1994                                    | 1,032.3        | 833.5      | 1,745.1    | 1,647.5        | 31.3%                        | 5,258.3                             |
| 1995                                    | 1,039.1        | 851.4      | 1,742.8    | 1,681.0        | 31.6%                        | 5,314.3                             |
| 1996                                    | 1,099.1        | 882.6      | 1,794.5    | 1,725.1        | 31.4%                        | 5,501.4                             |
| 1997                                    | 1,089.8        | 926.0      | 1,814.8    | 1,744.1        | 31.3%                        | 5,574.8                             |
| 1998                                    | 1,097.5        | 946.8      | 1,795.8    | 1,781.7        | 31.7%                        | 5,621.8                             |
| 1999                                    | 1,121.6        | 960.4      | 1,771.6    | 1,828.0        | 32.2%                        | 5,681.5                             |
| 2000                                    | 1,185.1        | 1,022.0    | 1,788.1    | 1,872.0        | 31.9%                        | 5,867.2                             |
| 2001                                    | 1,171.5        | 1,027.3    | 1,709.2    | 1,851.5        | 32.1%                        | 5,759.5                             |
| 2002                                    | 1,203.7        | 1,027.0    | 1,685.8    | 1,892.4        | 32.6%                        | 5,808.7                             |
| 2003                                    | 1,230.1        | 1,036.0    | 1,691.9    | 1,898.9        | 32.4%                        | 5,856.9                             |
| 2004                                    | 1,227.8        | 1,053.5    | 1,731.1    | 1,962.3        | 32.8%                        | 5,974.7                             |
| 2005                                    | 1,261.5        | 1,069.0    | 1,675.2    | 1,990.7        | 33.2%                        | 5,996.4                             |
| 2006                                    | 1,192.0        | 1,043.4    | 1,661.1    | 2,021.9        | 34.2%                        | 5,918.3                             |
| 2007                                    | 1,242.0        | 1,078.6    | 1,661.6    | 2,039.6        | 33.9%                        | 6,021.8                             |
| 2008                                    | 1,229.0        | 1,073.5    | 1,597.6    | 1,937.9        | 33.2%                        | 5,838.0                             |
| 2009                                    | 1,162.2        | 1,003.6    | 1,405.4    | 1,854.5        | 34.2%                        | 5,425.6                             |
| <i>Average annual percentage change</i> |                |            |            |                |                              |                                     |
| 1990–2009                               | 1.0%           | 1.3%       | -1.0%      | 0.8%           |                              | 0.4%                                |
| 2000–2009                               | -0.2%          | -0.2%      | -2.4%      | -0.1%          |                              | -0.8%                               |

**Source:**

U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States, 2009*, Washington, DC, March 31, 2011, Table 7. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

**Note:** Emissions from U.S. Territories are not included. International bunker fuels and military bunker fuels are included in these data.

<sup>a</sup> Includes energy from petroleum, coal, and natural gas. Electric utility emissions are distributed across consumption sectors.



*Most U.S. transportation sector carbon dioxide emissions come from petroleum fuels (98%). Motor gasoline has been responsible for about 60% of U.S. carbon dioxide emissions over the last twenty years.*

**Table 11.6**  
**U.S. Carbon Emissions from Energy Use in the Transportation Sector, 1990–2009**  
 (million metric tonnes of carbon dioxide)

| Fuel                     | 1990           |               | 2000           |               | 2009           |               |
|--------------------------|----------------|---------------|----------------|---------------|----------------|---------------|
|                          | Emissions      | Percentage    | Emissions      | Percentage    | Emissions      | Percentage    |
| <b>Petroleum</b>         |                |               |                |               |                |               |
| Motor gasoline           | 966.8          | 60.9%         | 1,121.3        | 59.9%         | 1,137.5        | 61.3%         |
| LPG <sup>a</sup>         | 1.4            | 0.1%          | 0.8            | 0.0%          | 2.6            | 0.1%          |
| Jet fuel                 | 222.6          | 14.0%         | 253.8          | 13.6%         | 204.4          | 11.0%         |
| Distillate fuel          | 267.8          | 16.9%         | 377.8          | 20.2%         | 404.7          | 21.8%         |
| Residual fuel            | 80.1           | 5.0%          | 69.9           | 3.7%          | 59.9           | 3.2%          |
| Lubricants               | 6.5            | 0.4%          | 6.7            | 0.4%          | 4.7            | 0.3%          |
| Aviation gas             | 3.1            | 0.2%          | 2.5            | 0.1%          | 1.8            | 0.1%          |
| <b>Subtotal</b>          | <b>1,548.4</b> | <b>97.5%</b>  | <b>1,832.8</b> | <b>97.9%</b>  | <b>1,815.7</b> | <b>97.9%</b>  |
| <b>Other energy</b>      |                |               |                |               |                |               |
| Natural gas              | 36.1           | 2.3%          | 35.7           | 1.9%          | 34.1           | 1.8%          |
| Electricity <sup>b</sup> | 3.2            | 0.2%          | 3.6            | 0.2%          | 4.7            | 0.3%          |
| <b>Total<sup>c</sup></b> | <b>1,587.7</b> | <b>100.0%</b> | <b>1,872.0</b> | <b>100.0%</b> | <b>1,854.5</b> | <b>100.0%</b> |

**Source:**

U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States, 2009*, Washington, DC, March 31, 2011, Table 11 and annual. (Additional resources: [www.eia.doe.gov](http://www.eia.doe.gov))

<sup>a</sup> Liquified petroleum gas.

<sup>b</sup> Share of total electric utility carbon dioxide emissions weighted by sales to the transportation sector.

<sup>c</sup> Totals may not equal sum of components due to independent rounding.



*Highway vehicles are responsible for the majority of greenhouse gas emissions in the transportation sector.*

**Table 11.7**  
**Transportation Greenhouse Gas Emissions by Mode, 1990 and 2009**  
**(Million metric tonnes of carbon dioxide equivalent)**

|                                 | Carbon Dioxide | Methane | Nitrous Oxide |
|---------------------------------|----------------|---------|---------------|
| 1990                            |                |         |               |
| Highway Total                   | 1,190.5        | 4.2     | 40.4          |
| Cars, light trucks, motorcycles | 952.2          | 4.0     | 39.6          |
| Medium & heavy trucks and buses | 238.3          | 0.2     | 0.8           |
| Water                           | 44.5           | 0.0     | 0.6           |
| Air                             | 179.3          | 0.2     | 1.7           |
| Rail                            | 38.5           | 0.1     | 0.3           |
| Pipeline                        | 36.0           | 0.0     | 0.0           |
| Other                           | 0.0            | 0.2     | 0.9           |
| Total <sup>a</sup>              | 1,489.0        | 4.7     | 43.9          |
| 2009                            |                |         |               |
| Highway Total                   | 1,478.3        | 1.8     | 24.2          |
| Cars, light trucks, motorcycles | 1,108.3        | 1.7     | 23.2          |
| Medium & heavy trucks and buses | 370.0          | 0.1     | 1.0           |
| Water                           | 28.5           | 0.0     | 0.4           |
| Air                             | 140.6          | 0.1     | 1.3           |
| Rail                            | 40.6           | 0.1     | 0.3           |
| Pipeline                        | 35.2           | 0.0     | 0.0           |
| Other                           | 0.0            | 0.2     | 1.5           |
| Total <sup>a</sup>              | 1,723.3        | 2.2     | 27.7          |
| Percent change 1990–2009        |                |         |               |
| Highway Total                   | 24.2%          | -57.1%  | -40.1%        |
| Cars, light trucks, motorcycles | 16.4%          | -57.5%  | -41.4%        |
| Medium & heavy trucks and buses | 55.3%          | -50.0%  | 25.0%         |
| Water                           | -36.0%         | 0.0%    | -33.3%        |
| Air                             | -21.6%         | -50.0%  | -23.5%        |
| Rail                            | 5.5%           | 0.0%    | 0.0%          |
| Pipeline                        | -2.2%          | 0.0%    | 0.0%          |
| Other                           | 0.0%           | 0.0%    | 66.7%         |
| Total <sup>a</sup>              | 15.7%          | -53.2%  | -36.9%        |

**Source:**

U.S. Environmental Protection Agency, Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2009, Tables 3-12, 3-13, 3-14, February 2011. (Additional resources: [www.epa.gov/climatechange/emissions](http://www.epa.gov/climatechange/emissions))

**Note:** Emissions from U.S. Territories, International bunker fuels, and military bunker fuels are not included.

<sup>a</sup> The sums of subcategories may not equal due to rounding.

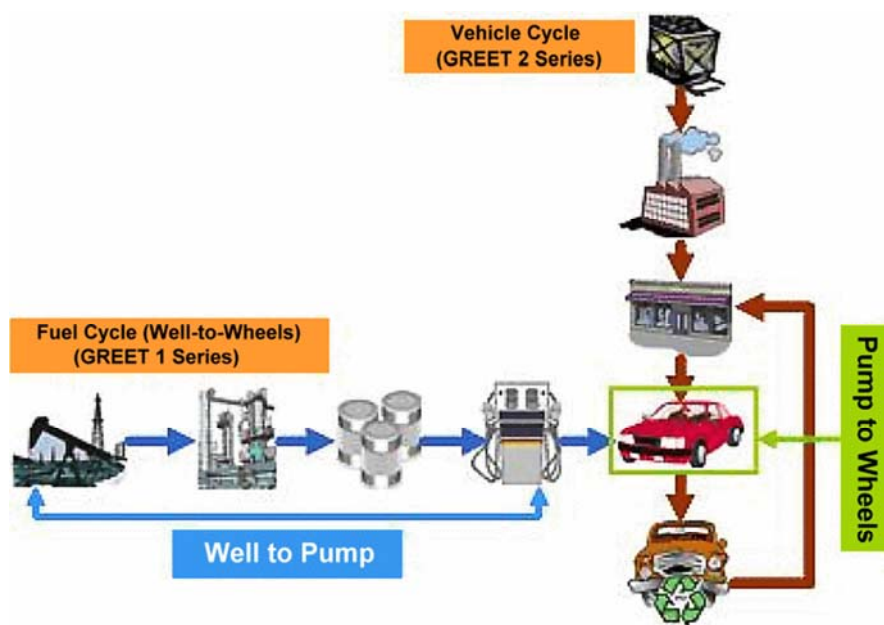


## The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model

[http://www.transportation.anl.gov/modeling\\_simulation/GREET/](http://www.transportation.anl.gov/modeling_simulation/GREET/)

Sponsored by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE), Argonne has developed a full life-cycle model called GREET (Greenhouse gases, Regulated Emissions, and Energy use in Transportation). It allows researchers and analysts to evaluate energy and emission impacts of various vehicle and fuel combinations on a full fuel-cycle/vehicle-cycle basis. The first version of GREET was released in 1996. Since then, Argonne has continued to update and expand the model. The most recent GREET versions are GREET 1.8c.0 version for fuel-cycle analysis and GREET 2.7 version for vehicle-cycle analysis.

**Figure 11.1. GREET Model**



For a given vehicle and fuel system, GREET separately calculates the following:

- Consumption of total energy (energy in non-renewable and renewable sources), fossil fuels (petroleum, natural gas, and coal together), petroleum, coal and natural gas.
- Emissions of CO<sub>2</sub>-equivalent greenhouse gases - primarily carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O).

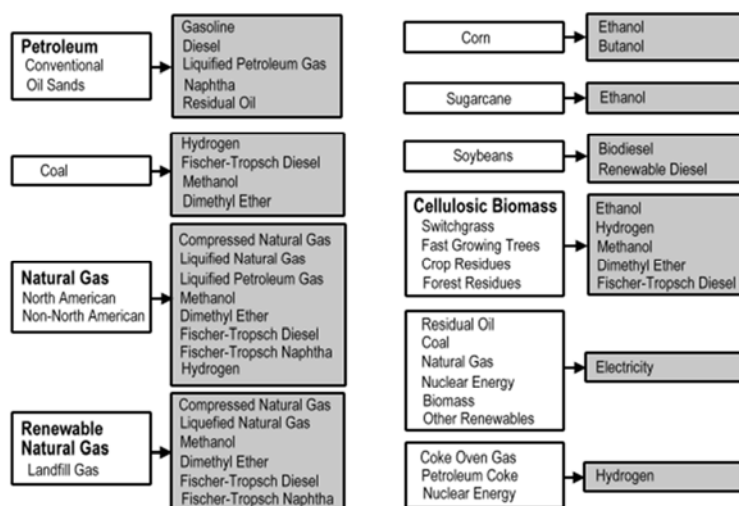


- Emissions of six criteria pollutants: volatile organic compounds (VOCs), carbon monoxide (CO), nitrogen oxide (NO<sub>x</sub>), particulate matter with size smaller than 10 micron (PM<sub>10</sub>), particulate matter with size smaller than 2.5 micron (PM<sub>2.5</sub>), and sulfur oxides (SO<sub>x</sub>).

REET includes more than 100 fuel production pathways and more than 80 vehicle/fuel systems. These vehicle/fuel systems cover all major vehicle technologies in the market and R&D arena:

- Conventional spark-ignition (SI) engines
- Direct-injection, SI engines
- Direct injection, compression-ignition (CI) engines
- Grid-independent hybrid electric vehicles (both SI and CI)
- Grid-connected (or plug-in) hybrid electric vehicles (both SI and CI)
- Battery-powered electric vehicles
- Fuel-cell vehicles

**Figure 11.2. REET Model Feedstocks and Fuels**



To address technology improvements over time, REET simulates vehicle/fuel systems over the period from 1990 to 2035, in five-year intervals.

For additional information about the REET model, see the REET Web site, or contact:

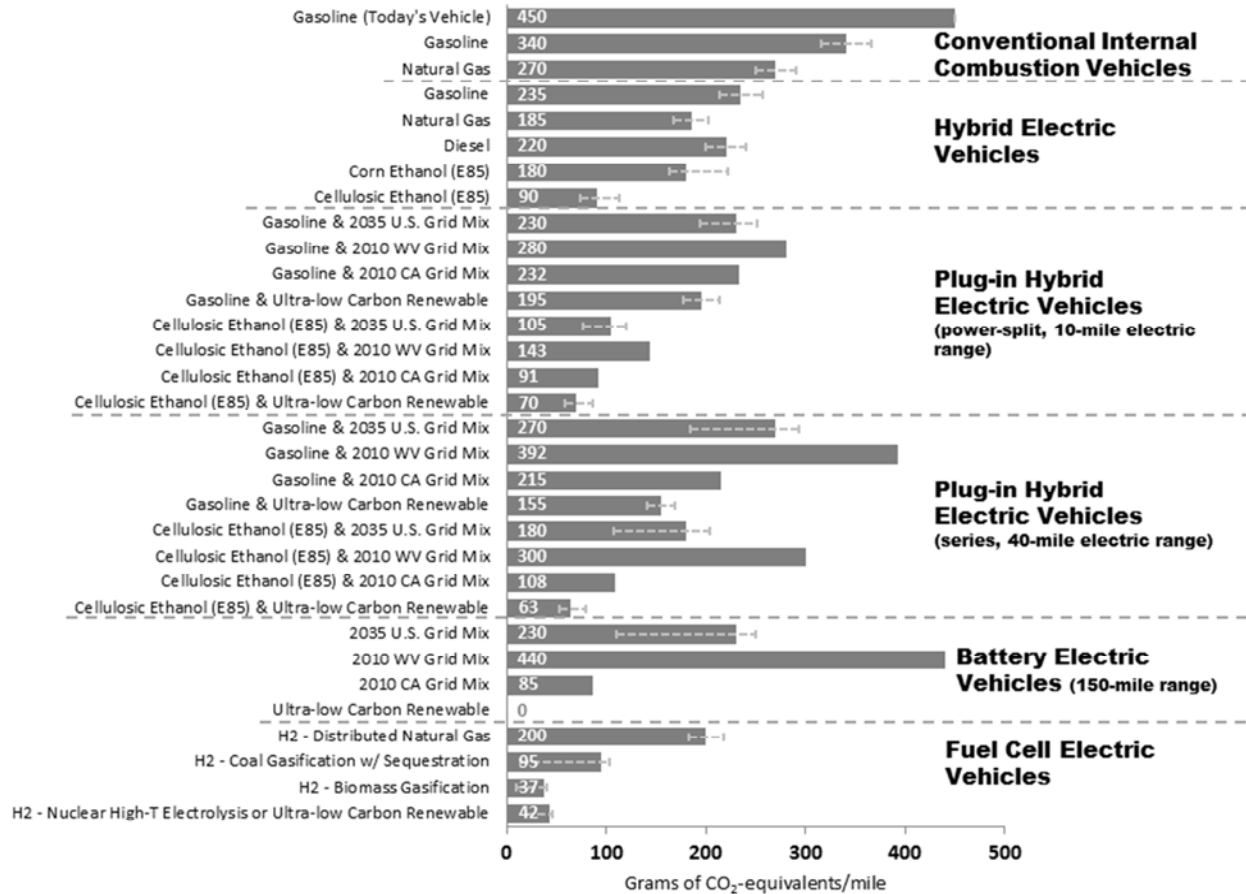
Michael Q. Wang  
 Argonne National Laboratory  
 9700 South Cass Avenue, ES/362  
 Argonne, IL 60439-4815  
 phone: 630-252-2819  
 fax: 630-252-3443  
 email: mqwang@anl.gov





*These are results from the latest GREET model (see preceding pages for description). California's (CA) grid mix was chosen due to the high renewable energy mix in that state. While in contrast, West Virginia's (WV) grid mix is primarily coal. Both of these are compared against the average U.S. grid mix for various vehicle technologies.*

**Figure 11.3. Well-to-Wheel Emissions for Various Fuels and Vehicle Technologies**



**Source:** Argonne National Laboratory, GREET Model 1.8d.1.

**Note:** H2 = hydrogen; High-T = high-temperature.



## Carbon Footprint

The carbon footprint measures a vehicle's impact on climate change in tons of carbon dioxide (CO<sub>2</sub>) emitted annually. The following three tables show the carbon footprint for various vehicle classes. The sales-weighted average fuel economy rating for each vehicle class, based on 45% highway and 55% city driving, is used to determine the average annual carbon footprint for vehicles in the class. An estimate of 15,000 annual miles is used for each vehicle class and for each year in the series. The equation to calculate carbon footprint uses results of the GREET model version 1.8.

$$\text{CarbonFootprint} = \left( CO_2 \times LHV \times \frac{\text{AnnualMiles}}{\text{CombinedMPG}} \right) + (CH_4 + N_2O) \times \text{AnnualMiles}$$

where:

CO<sub>2</sub> = (Tailpipe CO<sub>2</sub> + Upstream Greenhouse Gases) in grams per million Btu

LHV = Lower (or net) Heating Value in million Btu per gallon

CH<sub>4</sub> = Tailpipe CO<sub>2</sub> equivalent methane in grams per mile

N<sub>2</sub>O = Tailpipe CO<sub>2</sub> equivalent nitrous oxide in grams per mile



*The carbon footprint for all classifications of cars declined between 1975 and 2010. Midsize cars have experienced the greatest reduction in carbon footprint with a decrease of almost 59%.*

**Table 11.8**  
**Sales-Weighted Annual Carbon Footprint of New Domestic and Import Cars by Size Class,**  
**Model Years 1975–2010<sup>a</sup>**  
**(short tons of CO<sub>2</sub>)**

| Sales period                            | Cars  |         |       | Wagons |         |              |
|---|-------|---------|-------|--------|---------|--------------|
|   | Small | Midsize | Large | Small  | Midsize | Large        |
| 1975                                    | 10.2  | 13.7    | 14.2  | 8.3    | 14.1    | 15.6         |
| 1976                                    | 9.4   | 11.9    | 13.1  | 7.8    | 11.6    | 13.8         |
| 1977                                    | 9.0   | 11.4    | 11.7  | 7.3    | 11.4    | 12.0         |
| 1978                                    | 8.1   | 10.0    | 11.1  | 7.7    | 10.0    | 11.7         |
| 1979                                    | 8.0   | 9.8     | 10.7  | 7.3    | 9.8     | 11.6         |
| 1980                                    | 7.2   | 8.6     | 9.8   | 6.5    | 8.8     | 9.8          |
| 1981                                    | 6.6   | 8.2     | 9.2   | 6.2    | 8.1     | 9.4          |
| 1982                                    | 6.4   | 7.8     | 9.0   | 6.1    | 7.9     | 9.7          |
| 1983                                    | 6.4   | 7.8     | 9.2   | 5.8    | 7.7     | 9.5          |
| 1984                                    | 6.4   | 7.8     | 9.1   | 5.9    | 7.5     | 9.4          |
| 1985                                    | 6.3   | 7.5     | 8.4   | 5.8    | 7.4     | 8.9          |
| 1986                                    | 6.2   | 7.2     | 7.8   | 6.0    | 7.2     | 8.5          |
| 1987                                    | 6.2   | 7.2     | 7.8   | 6.1    | 7.3     | 8.5          |
| 1988                                    | 6.1   | 7.0     | 7.7   | 6.0    | 7.1     | 8.2          |
| 1989                                    | 6.2   | 7.0     | 7.8   | 5.9    | 7.3     | 8.3          |
| 1990                                    | 6.3   | 7.1     | 7.9   | 6.3    | 7.4     | 8.2          |
| 1991                                    | 6.2   | 7.2     | 7.9   | 6.1    | 7.2     | 8.2          |
| 1992                                    | 6.2   | 7.2     | 7.9   | 6.2    | 7.1     | 8.2          |
| 1993                                    | 6.1   | 7.2     | 7.7   | 5.8    | 7.1     | 8.3          |
| 1994                                    | 6.2   | 7.2     | 7.8   | 5.7    | 7.2     | 8.2          |
| 1995                                    | 6.1   | 7.2     | 7.7   | 5.6    | 7.0     | 8.2          |
| 1996                                    | 6.1   | 7.1     | 7.7   | 5.9    | 7.1     | 8.1          |
| 1997                                    | 6.1   | 7.1     | 7.6   | 5.8    | 7.1     | <sup>b</sup> |
| 1998                                    | 6.1   | 6.9     | 7.6   | 5.8    | 7.1     | <sup>b</sup> |
| 1999                                    | 6.2   | 6.9     | 7.5   | 5.9    | 7.1     | <sup>b</sup> |
| 2000                                    | 6.2   | 6.9     | 7.3   | 6.4    | 6.9     | <sup>b</sup> |
| 2001                                    | 6.1   | 6.9     | 7.4   | 6.9    | 7.0     | <sup>b</sup> |
| 2002                                    | 6.1   | 6.8     | 7.2   | 7.2    | 6.8     | <sup>b</sup> |
| 2003                                    | 6.1   | 6.6     | 7.2   | 6.2    | 6.9     | <sup>b</sup> |
| 2004                                    | 6.1   | 6.5     | 7.2   | 6.0    | 7.1     | 8.5          |
| 2005                                    | 6.0   | 6.3     | 7.1   | 5.8    | 7.2     | 8.4          |
| 2006                                    | 6.0   | 6.3     | 7.2   | 6.0    | 7.1     | 8.5          |
| 2007                                    | 5.9   | 6.0     | 7.2   | 5.9    | 6.9     | 8.5          |
| 2008                                    | 5.9   | 6.0     | 6.9   | 5.8    | 7.0     | 8.6          |
| 2009                                    | 5.6   | 5.8     | 6.6   | 5.6    | 6.7     | 8.7          |
| 2010                                    | 5.5   | 5.7     | 6.6   | 5.4    | 6.6     | 8.9          |
| <i>Average annual percentage change</i> |       |         |       |        |         |              |
| 1975–2010                               | -1.7% | -2.5%   | -2.2% | -1.2%  | -2.1%   | -1.6%        |
| 2000–2010                               | -1.2% | -1.9%   | -1.0% | -1.7%  | -0.4%   | <sup>c</sup> |

**Source:**

Calculated using fuel economy from the U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2010*, November 2010. See page 11-12 for details.

<sup>a</sup> Annual carbon footprint is based on 15,000 miles of annual driving.

<sup>b</sup> No vehicles in this category were sold in this model year.

<sup>c</sup> Data are not available.



*The annual carbon footprint of light trucks decreased for all classes of light trucks between 1975 and 2010. In the last ten years, large SUVs experienced the greatest decline with about 24% while small SUVs experienced a slight gain in carbon emissions.*

**Table 11.9**  
**Sales-Weighted Annual Carbon Footprint of New Domestic and Import Light Trucks by Size Class,**  
**Model Years 1975–2010<sup>a</sup>**  
**(short tons of CO<sub>2</sub>)**

| Sales period                            | Pickups      |         |       | Vans         |         |       | SUVs  |         |       |
|---|--------------|---------|-------|--------------|---------|-------|-------|---------|-------|
|   | Small        | Midsize | Large | Small        | Midsize | Large | Small | Midsize | Large |
| 1975                                    | 8.3          | 8.8     | 14.2  | 9.1          | 14.0    | 14.8  | 11.6  | 15.4    | 15.3  |
| 1980                                    | 7.7          | 7.2     | 10.8  | 9.8          | 11.0    | 11.6  | 9.9   | 13.0    | 13.0  |
| 1981                                    | 6.6          | 7.1     | 10.0  | 10.1         | 10.4    | 11.1  | 9.2   | 11.9    | 12.2  |
| 1982                                    | 6.9          | 7.0     | 10.0  | 8.6          | 10.4    | 11.6  | 9.1   | 11.4    | 9.9   |
| 1983                                    | 7.0          | 7.1     | 10.3  | 9.5          | 10.0    | 11.5  | 8.7   | 9.9     | 10.6  |
| 1984                                    | 7.2          | 7.3     | 10.5  | 7.3          | 9.7     | 11.4  | 8.6   | 9.9     | 11.0  |
| 1985                                    | 7.0          | 7.3     | 10.5  | 7.3          | 9.4     | 11.6  | 8.5   | 9.5     | 11.0  |
| 1986                                    | 7.2          | 7.2     | 10.2  | 7.3          | 9.0     | 10.6  | 7.9   | 9.5     | 11.1  |
| 1987                                    | 7.2          | 7.4     | 10.5  | 7.7          | 8.8     | 11.0  | 7.7   | 9.4     | 11.0  |
| 1988                                    | 7.5          | 7.4     | 10.4  | 7.6          | 8.6     | 11.0  | 7.7   | 9.6     | 11.2  |
| 1989                                    | 7.8          | 7.5     | 10.3  | 7.5          | 8.6     | 11.1  | 8.2   | 9.6     | 11.2  |
| 1990                                    | 7.5          | 7.6     | 10.4  | 7.8          | 8.6     | 11.3  | 8.0   | 9.8     | 11.2  |
| 1991                                    | 7.5          | 7.6     | 10.2  | 7.8          | 8.5     | 11.2  | 7.9   | 9.2     | 11.5  |
| 1992                                    | 7.6          | 7.9     | 10.2  | 6.9          | 8.6     | 11.0  | 8.0   | 9.4     | 11.9  |
| 1993                                    | 7.1          | 7.9     | 10.0  | 6.6          | 8.4     | 11.0  | 8.1   | 9.3     | 11.4  |
| 1994                                    | 7.5          | 7.8     | 10.1  | 6.9          | 8.5     | 11.0  | 7.8   | 9.4     | 11.4  |
| 1995                                    | 7.7          | 7.6     | 10.4  | 7.1          | 8.4     | 10.9  | 7.7   | 9.5     | 11.2  |
| 1996                                    | 7.6          | 7.5     | 10.2  | 7.1          | 8.2     | 10.9  | 6.6   | 9.3     | 10.8  |
| 1997                                    | 7.5          | 7.7     | 9.9   | <sup>b</sup> | 8.3     | 10.0  | 8.2   | 9.1     | 10.7  |
| 1998                                    | 7.6          | 7.8     | 10.0  | <sup>b</sup> | 8.0     | 10.2  | 7.9   | 9.0     | 10.7  |
| 1999                                    | 8.1          | 8.3     | 10.1  | <sup>b</sup> | 8.1     | 10.4  | 7.8   | 8.9     | 10.8  |
| 2000                                    | 7.1          | 8.2     | 9.7   | <sup>b</sup> | 8.0     | 10.4  | 8.3   | 8.9     | 10.6  |
| 2001                                    | 7.1          | 8.6     | 9.9   | <sup>b</sup> | 7.8     | 10.5  | 7.5   | 8.6     | 10.1  |
| 2002                                    | 8.1          | 8.8     | 10.0  | <sup>b</sup> | 7.9     | 10.4  | 7.6   | 8.6     | 9.8   |
| 2003                                    | 8.1          | 8.2     | 9.9   | <sup>b</sup> | 7.8     | 10.0  | 7.4   | 8.3     | 9.9   |
| 2004                                    | 8.3          | 8.6     | 9.8   | <sup>b</sup> | 7.8     | 9.6   | 7.6   | 8.3     | 9.9   |
| 2005                                    | 7.2          | 7.9     | 9.6   | <sup>b</sup> | 7.7     | 9.6   | 7.7   | 8.1     | 9.4   |
| 2006                                    | 7.0          | 7.8     | 9.5   | <sup>b</sup> | 7.6     | 9.6   | 8.7   | 7.9     | 9.2   |
| 2007                                    | <sup>b</sup> | 8.0     | 9.5   | <sup>b</sup> | 7.7     | 9.4   | 8.3   | 7.6     | 8.9   |
| 2008                                    | <sup>b</sup> | 7.8     | 9.3   | 6.1          | 7.6     | 9.3   | 8.2   | 7.3     | 8.8   |
| 2009                                    | <sup>b</sup> | 7.6     | 9.2   | 6.2          | 7.5     | 9.3   | 9.0   | 7.0     | 8.2   |
| 2010                                    | <sup>b</sup> | 7.4     | 9.1   | 6.1          | 7.4     | 9.3   | 8.7   | 6.8     | 8.1   |
| <i>Average annual percentage change</i> |              |         |       |              |         |       |       |         |       |
| 1975-2010                               | <sup>c</sup> | -0.5%   | -1.2% | -1.0%        | -1.7%   | -1.2% | -0.8% | -2.1%   | -1.7% |
| 2000-2010                               | <sup>c</sup> | -1.0%   | -0.6% | <sup>c</sup> | -0.8%   | -1.1% | 0.5%  | -2.7%   | -2.7% |

**Source:**

Calculated using fuel economy from the U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2010*, November 2010. See page 11-12 for details.

**Note:** Includes light trucks of 8,500 lbs. or less.

<sup>a</sup> Annual carbon footprint is based on 15,000 miles of annual driving.

<sup>b</sup> No vehicles in this category were sold in this model year.

<sup>c</sup> Data are not available.



*Between 1975 and 2010, the carbon footprint for light vehicles sold in the United States dropped dramatically. Cars experienced the greatest decrease at 51.4% while the carbon footprint for light trucks decreased by 42.2%.*

**Table 11.10**  
**Average Annual Carbon Footprint by Vehicle Classification, 1975 and 2010<sup>a</sup>**  
**(short tons of CO<sub>2</sub>)**

| Fuel                      | Market Share |              | Carbon Footprint |              | Percent Change |
|---------------------------|--------------|--------------|------------------|--------------|----------------|
|                           | 1975         | 2010         | 1975             | 2010         | 1975 - 2010    |
| <b>Cars</b>               |              |              |                  |              |                |
| Small                     | 40.0%        | 23.7%        | 10.2             | 5.5          | -45.9%         |
| Midsize                   | 16.0%        | 21.9%        | 13.7             | 5.7          | -58.4%         |
| Large                     | 15.2%        | 18.0%        | 14.2             | 6.6          | -53.5%         |
| Small Wagon               | 4.7%         | 4.5%         | 8.3              | 5.4          | -34.9%         |
| Midsize Wagon             | 2.8%         | 0.8%         | 14.1             | 6.6          | -53.2%         |
| Large Wagon               | 1.9%         | 0.1%         | 15.6             | 8.9          | -42.9%         |
| <b>Total Cars</b>         | <b>80.6%</b> | <b>58.9%</b> | <b>11.8</b>      | <b>5.7</b>   | <b>-51.4%</b>  |
| <b>Light Trucks</b>       |              |              |                  |              |                |
| Small Van                 | 0.0%         | 0.1%         | 9.1              | 6.1          | -33.0%         |
| Midsize Van               | 3.0%         | 3.3%         | 14.0             | 7.4          | -47.1%         |
| Large Van                 | 1.5%         | 0.1%         | 14.8             | 9.3          | -37.2%         |
| Small SUV                 | 0.5%         | 0.5%         | 11.6             | 8.7          | -25.0%         |
| Midsize SUV               | 1.2%         | 14.0%        | 15.4             | 6.8          | -55.8%         |
| Large SUV                 | 0.1%         | 10.4%        | 15.3             | 8.1          | -47.1%         |
| Small Pickup              | 1.6%         | 0.0%         | 8.3              | <sup>c</sup> | <sup>c</sup>   |
| Midsize Pickup            | 0.5%         | 1.4%         | 8.8              | 7.4          | -15.9%         |
| Large Pickup              | 11.0%        | 11.2%        | 14.2             | 9.1          | -35.9%         |
| <b>Total Light Trucks</b> | <b>19.4%</b> | <b>41.1%</b> | <b>13.6</b>      | <b>7.9</b>   | <b>-42.2%</b>  |

**Source:**

Calculated using fuel economy from the U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2010*, November 2010. See page 11-10 for details.

<sup>a</sup> Annual carbon footprint is based on 15,000 miles of annual driving.

<sup>b</sup> Data are not available.

<sup>c</sup> Not applicable.



*The amount of carbon dioxide released into the atmosphere by a vehicle is primarily determined by the carbon content of the fuel. However, there is a small portion of the fuel that is not oxidized into carbon dioxide when the fuel is burned. The Environmental Protection Agency (EPA) has published information on carbon dioxide emissions from gasoline and diesel which takes the oxidation factor into account and is based on the carbon content used in EPA's fuel economy analyses. The other fuels listed come from the Energy Information Administration.*

**Table 11.11**  
**Carbon Dioxide Emissions from a Gallon of Fuel**

|                   | Grams<br>per gallon | Kilograms<br>per gallon | Pounds<br>per gallon |
|-------------------|---------------------|-------------------------|----------------------|
| Gasoline          | 8,788               | 8.8                     | 19.4                 |
| Diesel            | 10,084              | 10.1                    | 22.2                 |
| LPG               | 5,805               | 5.8                     | 12.8                 |
| Propane           | 5,760               | 5.8                     | 12.7                 |
| Aviation gasoline | 8,345               | 8.3                     | 18.4                 |
| Jet fuel          | 9,569               | 9.6                     | 21.1                 |
| Keosene           | 9,751               | 9.8                     | 21.5                 |
| Residual fuel     | 11,791              | 11.8                    | 26.0                 |

**Sources:**

Gasoline and Diesel: U.S. Environmental Protection Agency, "Emission Facts: Average Carbon Dioxide Emissions Resulting from Gasoline and Diesel Fuel," February 2009. (Additional resources: [www.epa.gov/OMS](http://www.epa.gov/OMS))

All others: Energy Information Administration, Voluntary Reporting of Greenhouse Gases Program, Fuel and Energy Source Codes and Emission Coefficients.



## Chapter 12

### Criteria Air Pollutants

Summary Statistics from Tables in this Chapter

| Source     |  |       |
|------------|--|-------|
| Table 12.1 | Transportation's share of U.S. emissions, 2008 |       |
|            | <i>CO</i>                                      | 73.2% |
|            | <i>NO<sub>x</sub></i>                          | 57.9% |
|            | <i>VOC</i>                                     | 37.7% |
|            | <i>PM-2.5</i>                                  | 7.2%  |
|            | <i>SO<sub>2</sub></i>                          | 4.5%  |
|            | <i>PM-10</i>                                   | 3.2%  |

**Note:** The latest available data are 2008.



*Transportation accounts for the majority of carbon monoxide and nitrogen oxide emissions. Highway vehicles are responsible for the largest share of transportation emissions.*

**Table 12.1**  
**Total National Emissions of the Criteria Air Pollutants by Sector, 2008**  
 (millions of short tons/percentage)

| Sector                                    | CO           | NO <sub>x</sub> | VOC          | PM-10        | PM-2.5      | SO <sub>2</sub> |
|---|--------------|-----------------|--------------|--------------|-------------|-----------------|
| <b>Highway vehicles</b>                   | <b>38.87</b> | <b>5.21</b>     | <b>3.42</b>  | <b>0.17</b>  | <b>0.11</b> | <b>0.06</b>     |
|   | 50.0%        | 31.9%           | 21.5%        | 1.2%         | 0.1%        | 0.6%            |
| <b>Other off-highway</b>                  | <b>18.04</b> | <b>4.26</b>     | <b>2.59</b>  | <b>0.30</b>  | <b>0.28</b> | <b>0.46</b>     |
|   | 23.2%        | 26.0%           | 16.2%        | 2.1%         | 5.1%        | 4.0%            |
| <b>Transportation total</b>               | <b>56.90</b> | <b>9.46</b>     | <b>6.00</b>  | <b>0.48</b>  | <b>0.39</b> | <b>0.52</b>     |
|   | 73.2%        | 57.9%           | 37.7%        | 3.2%         | 7.2%        | 4.5%            |
| <b>Stationary source fuel combustion</b>  | <b>5.28</b>  | <b>5.57</b>     | <b>1.45</b>  | <b>1.33</b>  | <b>1.03</b> | <b>9.80</b>     |
|   | 6.8%         | 34.1%           | 9.1%         | 9.0%         | 19.0%       | 85.7%           |
| <b>Industrial processes</b>               | <b>2.18</b>  | <b>0.93</b>     | <b>6.77</b>  | <b>1.17</b>  | <b>0.48</b> | <b>1.00</b>     |
|   | 2.8%         | 5.7%            | 42.5%        | 7.9%         | 8.8%        | 8.7%            |
| <b>Waste disposal and recycling total</b> | <b>1.58</b>  | <b>0.12</b>     | <b>0.37</b>  | <b>0.29</b>  | <b>0.27</b> | <b>0.03</b>     |
|   | 2.0%         | 0.7%            | 2.3%         | 1.9%         | 4.9%        | 0.2%            |
| <b>Miscellaneous</b>                      | <b>11.73</b> | <b>0.26</b>     | <b>1.33</b>  | <b>11.54</b> | <b>3.28</b> | <b>0.09</b>     |
|   | 15.1%        | 1.6%            | 8.4%         | 77.9%        | 60.2%       | 0.7%            |
| <b>Total of all sources</b>               | <b>77.69</b> | <b>16.34</b>    | <b>15.93</b> | <b>14.81</b> | <b>5.45</b> | <b>11.43</b>    |
|   | 100.0%       | 100.0%          | 100.0%       | 100.0%       | 100.0%      | 100.0%          |

**Source:**

U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site [www.epa.gov/ttn/chief/trends](http://www.epa.gov/ttn/chief/trends). (Additional resources: [www.epa.gov/ttn/chief](http://www.epa.gov/ttn/chief))

**Note:** CO = Carbon monoxide. NO<sub>x</sub> = Nitrogen oxides. PM-10 = Particulate matter less than 10 microns. PM-2.5 = Particulate matter less than 2.5 microns. SO<sub>2</sub> = Sulfur dioxide. VOC = Volatile organic compounds. NH<sub>3</sub> = Ammonia. The latest available data are 2008.





*The transportation sector accounted for more than 73% of the nation's carbon monoxide (CO) emissions in 2008. Highway vehicles are by far the source of the greatest amount of CO. For details on the highway emissions of CO, see Table 12.3.*

**Table 12.2**  
**Total National Emissions of Carbon Monoxide, 1970–2008<sup>a</sup>**  
**(million short tons)**

| Source category                    | 1970          | 1980          | 1990          | 2000          | 2005         | 2008         | Percent of total, 2008 |
|------------------------------------|---------------|---------------|---------------|---------------|--------------|--------------|------------------------|
| Highway vehicles                   | 163.23        | 143.83        | 110.26        | 68.06         | 48.54        | 38.87        | 50.0%                  |
| Other off-highway                  | 11.37         | 16.69         | 21.45         | 24.18         | 20.67        | 18.04        | 23.2%                  |
| Transportation total               | 174.60        | 160.51        | 131.70        | 92.24         | 69.22        | 56.90        | 73.2%                  |
| Stationary fuel combustion total   | 4.63          | 7.30          | 5.51          | 4.78          | 5.13         | 5.28         | 6.8%                   |
| Industrial processes total         | 9.84          | 6.95          | 4.77          | 2.63          | 2.03         | 2.18         | 2.8%                   |
| Waste disposal and recycling total | 7.06          | 2.30          | 1.08          | 1.85          | 1.55         | 1.58         | 2.0%                   |
| Miscellaneous total                | 7.91          | 8.34          | 11.12         | 12.96         | 15.11        | 11.73        | 15.1%                  |
| <b>Total of all sources</b>        | <b>204.04</b> | <b>185.41</b> | <b>154.19</b> | <b>114.47</b> | <b>93.03</b> | <b>77.69</b> | <b>100.0%</b>          |

**Source:**

U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site [www.epa.gov/ttn/chief/trends](http://www.epa.gov/ttn/chief/trends) (Additional resources: [www.epa.gov/ttn/chief](http://www.epa.gov/ttn/chief))

**Note:** The latest available data are 2008.

<sup>a</sup> The sums of subcategories may not equal total due to rounding.



*Though gasoline-powered light vehicles continue to be responsible for the majority of carbon monoxide emissions from highway vehicles, the total pollution from light vehicles in 2005 is about a third of what it was in 1970. This is despite the fact that there were many more light vehicles on the road in 2005.*

**Table 12.3**  
**Emissions of Carbon Monoxide from Highway Vehicles, 1970–2005<sup>a</sup>**  
(million short tons)

| Source category              | 1970          | 1980          | 1990          | 1995         | 2000         | 2005         | Percent of total, 2005 |
|------------------------------|---------------|---------------|---------------|--------------|--------------|--------------|------------------------|
| <b>Gasoline powered</b>      |               |               |               |              |              |              |                        |
| Light vehicles & motorcycles | 119.14        | 98.21         | 67.24         | 46.54        | 36.40        | 24.19        | 50.2%                  |
| Light trucks <sup>b</sup>    | 22.27         | 28.83         | 32.23         | 29.81        | 27.04        | 21.19        | 43.9%                  |
| Heavy vehicles               | 21.27         | 15.35         | 8.92          | 5.96         | 3.42         | 1.97         | 4.1%                   |
| Total                        | 162.68        | 142.39        | 108.39        | 82.31        | 66.86        | 47.35        | 98.2%                  |
| <b>Diesel powered</b>        |               |               |               |              |              |              |                        |
| Light vehicles               | 0.01          | 0.03          | 0.04          | 0.02         | 0.01         | 0.01         | 0.0%                   |
| Light trucks <sup>b</sup>    | 0.06          | 0.05          | 0.03          | 0.02         | 0.01         | 0.01         | 0.0%                   |
| Heavy vehicles               | 0.49          | 1.36          | 1.81          | 1.53         | 1.19         | 0.85         | 1.8%                   |
| Total                        | 0.56          | 1.43          | 1.87          | 1.57         | 1.20         | 0.87         | 1.8%                   |
| <b>Total</b>                 |               |               |               |              |              |              |                        |
| <b>Highway vehicle total</b> | <b>163.23</b> | <b>143.83</b> | <b>110.26</b> | <b>83.88</b> | <b>68.06</b> | <b>48.22</b> | <b>100.0%</b>          |
| Percent diesel               | 0.3%          | 1.0%          | 1.7%          | 1.9%         | 1.8%         | 1.8%         |                        |

**Source:**

U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site [www.epa.gov/ttn/chief/trends](http://www.epa.gov/ttn/chief/trends). (Additional resources: [www.epa.gov/oar/oaqps](http://www.epa.gov/oar/oaqps))

**Note:** Data beyond 2005 are not available.

<sup>a</sup> The sums of subcategories may not equal total due to rounding.

<sup>b</sup> Less than 8,500 pounds.



*The transportation sector accounted for over half of the nation's nitrogen oxide (NO<sub>x</sub>) emissions in 2008, with the majority coming from highway vehicles. For details on the highway emissions of NO<sub>x</sub>, see Table 12.5.*

**Table 12.4**  
**Total National Emissions of Nitrogen Oxides, 1970–2008<sup>a</sup>**  
**(million short tons)**

| Source category                    | 1970         | 1980         | 1990         | 2000         | 2005         | 2008         | Percent of total, 2008 |
|------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|------------------------|
| Highway vehicles                   | 12.62        | 11.49        | 9.59         | 8.39         | 6.49         | 5.21         | 31.9%                  |
| Other off-highway                  | 2.65         | 3.35         | 3.78         | 4.17         | 4.89         | 4.26         | 26.0%                  |
| Transportation total               | 15.28        | 14.85        | 13.37        | 12.56        | 11.38        | 9.46         | 57.9%                  |
| Stationary fuel combustion total   | 10.06        | 11.32        | 10.89        | 8.82         | 6.34         | 5.57         | 34.1%                  |
| Industrial processes total         | 0.78         | 0.56         | 0.80         | 0.81         | 0.98         | 0.93         | 5.7%                   |
| Waste disposal and recycling total | 0.44         | 0.11         | 0.09         | 0.13         | 0.15         | 0.12         | 0.7%                   |
| Miscellaneous total                | 0.33         | 0.25         | 0.37         | 0.28         | 0.27         | 0.26         | 1.6%                   |
| <b>Total of all sources</b>        | <b>26.88</b> | <b>27.08</b> | <b>25.53</b> | <b>22.60</b> | <b>19.12</b> | <b>16.34</b> | <b>100.0%</b>          |

**Source:**

U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site [www.epa.gov/ttn/chief/trends](http://www.epa.gov/ttn/chief/trends) (Additional resources: [www.epa.gov/ttn/chief](http://www.epa.gov/ttn/chief))

**Note:** The latest available data are 2008.

<sup>a</sup> The sums of subcategories may not equal total due to rounding.



*Heavy diesel-powered vehicles were responsible for nearly one-half (44.1%) of highway vehicle nitrogen oxide emissions in 2005, while light gasoline vehicles were responsible for the rest.*

**Table 12.5**  
**Emissions of Nitrogen Oxides from Highway Vehicles, 1970–2005<sup>a</sup>**  
**(million short tons)**

| Source category              | 1970         | 1980         | 1990        | 1995        | 2000        | 2005        | Percent of total, 2005 |
|------------------------------|--------------|--------------|-------------|-------------|-------------|-------------|------------------------|
| <b>Gasoline powered</b>      |              |              |             |             |             |             |                        |
| Light vehicles & motorcycles | 8.54         | 6.63         | 4.26        | 3.05        | 2.31        | 1.63        | 25.5%                  |
| Light trucks <sup>b</sup>    | 1.54         | 1.58         | 1.50        | 1.46        | 1.44        | 1.56        | 24.4%                  |
| Heavy vehicles               | 0.72         | 0.62         | 0.57        | 0.52        | 0.45        | 0.38        | 5.9%                   |
| Total                        | 10.81        | 8.83         | 6.33        | 5.03        | 4.20        | 3.57        | 55.9%                  |
| <b>Diesel powered</b>        |              |              |             |             |             |             |                        |
| Light vehicles               | 0.00         | 0.03         | 0.04        | 0.02        | 0.01        | 0.00        | 0.0%                   |
| Light trucks <sup>b</sup>    | 0.07         | 0.05         | 0.02        | 0.01        | 0.01        | 0.01        | 0.2%                   |
| Heavy vehicles               | 1.76         | 2.59         | 3.19        | 3.82        | 4.18        | 2.81        | 44.0%                  |
| Total                        | 1.83         | 2.66         | 3.26        | 3.85        | 4.19        | 2.82        | 44.1%                  |
| <b>Total</b>                 |              |              |             |             |             |             |                        |
| <b>Highway vehicle total</b> | <b>12.64</b> | <b>11.49</b> | <b>9.59</b> | <b>8.88</b> | <b>8.39</b> | <b>6.39</b> | <b>100.0%</b>          |
| Percent diesel               | 14.5%        | 23.1%        | 34.0%       | 43.4%       | 49.9%       | 44.1%       |                        |

**Source:**

U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site [www.epa.gov/ttn/chief/trends](http://www.epa.gov/ttn/chief/trends). (Additional resources: [www.epa.gov/oar/oaqps](http://www.epa.gov/oar/oaqps))

**Note:** Data beyond 2005 are not available.

<sup>a</sup> The sums of subcategories may not equal total due to rounding.

<sup>b</sup> Less than 8,500 pounds.



*The transportation sector accounted for almost 38% of the nation's volatile organic compound (VOC) emissions in 2008, with the majority coming from highway vehicles. For details on the highway emissions of VOC, see Table 12.7.*

**Table 12.6**  
**Total National Emissions of Volatile Organic Compounds, 1970–2008<sup>a</sup>**  
**(million short tons)**

| Source category                    | 1970         | 1980         | 1990         | 2000         | 2005         | 2008         | Percent of total, 2008 |
|------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|------------------------|
| Highway vehicles                   | 16.91        | 13.87        | 9.39         | 5.33         | 4.11         | 3.42         | 21.5%                  |
| Off-highway                        | 1.62         | 2.19         | 2.66         | 2.64         | 2.87         | 2.59         | 16.2%                  |
| Transportation total               | 18.53        | 16.06        | 12.05        | 7.97         | 6.98         | 6.00         | 37.7%                  |
| Stationary fuel combustion total   | 0.72         | 1.05         | 1.01         | 1.18         | 1.77         | 1.45         | 9.1%                   |
| Industrial processes total         | 12.33        | 12.10        | 9.01         | 7.21         | 6.99         | 6.79         | 42.5%                  |
| Waste disposal and recycling total | 1.98         | 0.76         | 0.99         | 0.42         | 0.39         | 0.37         | 2.3%                   |
| Miscellaneous total                | 1.10         | 1.13         | 1.06         | 0.73         | 3.29         | 1.33         | 8.4%                   |
| <b>Total of all sources</b>        | <b>34.66</b> | <b>31.11</b> | <b>24.11</b> | <b>17.51</b> | <b>18.42</b> | <b>15.93</b> | <b>100.0%</b>          |

**Source:**

U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site [www.epa.gov/ttn/chief/trends](http://www.epa.gov/ttn/chief/trends) (Additional resources: [www.epa.gov/ttn/chief](http://www.epa.gov/ttn/chief))

**Note:** The latest available data are 2008.

<sup>a</sup> The sum of subcategories may not equal total due to rounding. The EPA's definition of volatile organic compounds excludes methane, ethane, and certain other nonphotochemically reactive organic compounds.



*Gasoline-powered vehicles are responsible for over 95% of highway vehicle emissions of volatile organic compounds. VOC emissions from highway vehicles in 2005 were about one-quarter of the 1990 level.*

**Table 12.7**  
**Emissions of Volatile Organic Compounds from Highway Vehicles, 1970–2005<sup>a</sup>**  
**(thousand short tons)**

| Source category              | 1970          | 1980          | 1990         | 1995         | 2000         | 2005         | Percent of total, 2005 |
|------------------------------|---------------|---------------|--------------|--------------|--------------|--------------|------------------------|
| <b>Gasoline powered</b>      |               |               |              |              |              |              |                        |
| Light vehicles & motorcycles | 11,996        | 9,304         | 5,690        | 3,768        | 2,903        | 2,111        | 51.8%                  |
| Light trucks <sup>b</sup>    | 2,776         | 2,864         | 2,617        | 2,225        | 1,929        | 1,629        | 39.9%                  |
| Heavy vehicles               | 1,679         | 1,198         | 633          | 421          | 256          | 171          | 4.2%                   |
| Total                        | 16,451        | 13,366        | 8,940        | 6,414        | 5,088        | 3,911        | 95.9%                  |
| <b>Diesel powered</b>        |               |               |              |              |              |              |                        |
| Light vehicles               | 8             | 16            | 18           | 9            | 3            | 2            | 0.0%                   |
| Light trucks <sup>b</sup>    | 41            | 28            | 15           | 10           | 4            | 6            | 0.1%                   |
| Heavy vehicles               | 411           | 459           | 415          | 315          | 230          | 159          | 3.9%                   |
| Total                        | 460           | 503           | 448          | 335          | 238          | 167          | 4.1%                   |
| <b>Total</b>                 |               |               |              |              |              |              |                        |
| <b>Highway vehicle total</b> | <b>16,911</b> | <b>13,869</b> | <b>9,388</b> | <b>6,749</b> | <b>5,326</b> | <b>4,078</b> | <b>100.0%</b>          |
| Percent diesel               | 2.7%          | 3.6%          | 4.8%         | 5.0%         | 4.5%         | 4.1%         |                        |

**Source:**

U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site [www.epa.gov/ttn/chief/trends](http://www.epa.gov/ttn/chief/trends) (Additional resources: [www.epa.gov/oar/oaqps](http://www.epa.gov/oar/oaqps))

**Note:** Data beyond 2005 are not available.

<sup>a</sup> The sums of subcategories may not equal total due to rounding.

<sup>b</sup> Less than 8,500 pounds.



*The transportation sector accounted for just over 3% of the nation's particulate matter (PM-10) emissions in 2008. For details on the highway emissions of PM-10, see Table 12.9.*

**Table 12.8**  
**Total National Emissions of Particulate Matter (PM-10), 1970–2008<sup>a</sup>**  
**(million short tons)**

| Source category                    | 1970         | 1980        | 1990         | 2000         | 2005         | 2008         | Percent of total, 2008 |
|------------------------------------|--------------|-------------|--------------|--------------|--------------|--------------|------------------------|
| Highway vehicles                   | 0.48         | 0.43        | 0.39         | 0.23         | 0.19         | 0.17         | 1.2%                   |
| Off-highway                        | 0.16         | 0.26        | 0.33         | 0.32         | 0.35         | 0.30         | 2.1%                   |
| Transportation total               | 0.64         | 0.69        | 0.72         | 0.55         | 0.54         | 0.48         | 3.2%                   |
| Stationary fuel combustion total   | 2.87         | 2.45        | 1.20         | 1.47         | 1.44         | 1.33         | 9.0%                   |
| Industrial processes total         | 7.67         | 2.75        | 1.04         | 0.71         | 1.22         | 1.17         | 7.9%                   |
| Waste disposal and recycling total | 1.00         | 0.27        | 0.27         | 0.36         | 0.29         | 0.29         | 1.9%                   |
| Miscellaneous total                | 0.84         | 0.85        | 24.54        | 20.65        | 17.66        | 11.54        | 77.9%                  |
| <b>Total of all sources</b>        | <b>13.02</b> | <b>7.01</b> | <b>27.75</b> | <b>23.75</b> | <b>21.15</b> | <b>14.81</b> | <b>100.0%</b>          |

**Source:**

U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site [www.epa.gov/ttn/chief/trends](http://www.epa.gov/ttn/chief/trends) (Additional resources: [www.epa.gov/ttn/chief](http://www.epa.gov/ttn/chief))

**Note:** Because PM-10 is fine particle matter less than 10 microns, it also includes PM-2.5. Specific data for PM-2.5 are shown on Tables 12.10 and 12.11. The latest available data are 2008.

<sup>a</sup> Fine particle matter less than 10 microns. The sums of subcategories may not equal total due to rounding.

<sup>b</sup> Data are not available.



*Since the mid-1980's, diesel-powered vehicles have been responsible for more than half of highway vehicle emissions of particulate matter (PM-10). Heavy vehicles are clearly the main source.*

**Table 12.9**  
**Emissions of Particulate Matter (PM-10) from Highway Vehicles, 1970–2005<sup>a</sup>**  
**(thousand short tons)**

| Source category              | 1970       | 1980       | 1990       | 1995       | 2000       | 2005       | Percent of total,<br>2005 |
|------------------------------|------------|------------|------------|------------|------------|------------|---------------------------|
| <b>Gasoline powered</b>      |            |            |            |            |            |            |                           |
| Light vehicles & motorcycles | 249        | 141        | 56         | 53         | 51         | 46         | 25.1%                     |
| Light trucks <sup>b</sup>    | 74         | 49         | 31         | 32         | 31         | 35         | 19.1%                     |
| Heavy vehicles               | 44         | 30         | 17         | 13         | 10         | 8          | 4.4%                      |
| Total                        | 367        | 220        | 104        | 98         | 92         | 89         | 48.6%                     |
| <b>Diesel powered</b>        |            |            |            |            |            |            |                           |
| Light vehicles               | 2          | 9          | 11         | 4          | 1          | 1          | 0.5%                      |
| Light trucks <sup>b</sup>    | 19         | 12         | 5          | 3          | 1          | 1          | 0.5%                      |
| Heavy vehicles               | 92         | 191        | 268        | 199        | 135        | 92         | 50.3%                     |
| Total                        | 113        | 212        | 284        | 206        | 137        | 94         | 51.4%                     |
| <b>Total</b>                 |            |            |            |            |            |            |                           |
| <b>Highway vehicle total</b> | <b>480</b> | <b>432</b> | <b>387</b> | <b>304</b> | <b>230</b> | <b>183</b> | <b>100.0%</b>             |
| Percent diesel               | 23.5%      | 49.1%      | 73.4%      | 67.8%      | 59.6%      | 51.4%      |                           |

**Source:**

U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site  
www.epa.gov/ttn/chieftrends (Additional resources: www.epa.gov/oar/oaqps)

**Note:** Because PM-10 is fine particle matter less than 10 microns, it also includes PM-2.5. Specific data for PM-2.5 are shown on Tables 12.10 and 12.11. Data beyond 2005 are not available.

<sup>a</sup> The sums of subcategories may not equal total due to rounding.

<sup>b</sup> Less than 8,500 pounds.





*The transportation sector accounted for only 4% of the nation's particulate matter (PM-2.5) emissions in 2008. For details on the highway emissions of PM-2.5, see Table 12.11.*

**Table 12.10**  
**Total National Emissions of Particulate Matter (PM-2.5), 1990–2008**  
**(million short tons)**

| Source category                    | 1990        | 1995        | 2000        | 2005        | 2006        | 2008        | Percent of total, 2008 |
|------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|------------------------|
| Highway vehicles                   | 0.32        | 0.25        | 0.17        | 0.14        | 0.13        | 0.11        | 2.2%                   |
| Off-highway                        | 0.30        | 0.31        | 0.30        | 0.32        | 0.31        | 0.28        | 5.8%                   |
| Transportation total               | 0.62        | 0.56        | 0.47        | 0.46        | 0.44        | 0.39        | 8.0%                   |
| Stationary fuel combustion total   | 0.91        | 0.90        | 1.29        | 1.13        | 1.09        | 1.01        | 20.6%                  |
| Industrial processes total         | 0.56        | 0.50        | 0.50        | 0.53        | 0.52        | 0.48        | 9.9%                   |
| Waste disposal and recycling total | 0.23        | 0.25        | 0.33        | 0.27        | 0.27        | 0.27        | 5.5%                   |
| Miscellaneous total                | 5.23        | 4.73        | 4.69        | 3.07        | 2.96        | 2.74        | 56.1%                  |
| <b>Total of all sources</b>        | <b>7.56</b> | <b>6.93</b> | <b>7.29</b> | <b>5.46</b> | <b>5.27</b> | <b>4.89</b> | <b>100.0%</b>          |

**Source:**

U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site [www.epa.gov/ttn/chief/trends](http://www.epa.gov/ttn/chief/trends) (Additional resources: [www.epa.gov/ttn/chief](http://www.epa.gov/ttn/chief))

**Note:** The latest available data are 2008.



*Diesel vehicles are responsible for the majority of highway vehicle PM-2.5 emissions. Nearly two-thirds of the highway vehicles' PM-2.5 emissions are from heavy diesel trucks.*

**Table 12.11**  
**Emissions of Particulate Matter (PM-2.5) from Highway Vehicles, 1990–2005<sup>a</sup>**  
**(thousand short tons)**

| Source category              | 1990       | 1995       | 2000       | 2005       | Percent of total, 2005 |
|------------------------------|------------|------------|------------|------------|------------------------|
| <b>Gasoline powered</b>      |            |            |            |            |                        |
| Light vehicles & motorcycles | 35         | 30         | 27         | 23         | 18.0%                  |
| Light trucks <sup>b</sup>    | 21         | 20         | 18         | 18         | 14.1%                  |
| Heavy vehicles               | 11         | 9          | 7          | 6          | 4.7%                   |
| Total                        | 67         | 59         | 52         | 47         | 36.7%                  |
| <b>Diesel powered</b>        |            |            |            |            |                        |
| Light vehicles               | 9          | 4          | 1          | 1          | 0.8%                   |
| Light trucks <sup>b</sup>    | 4          | 2          | 1          | 1          | 0.8%                   |
| Heavy vehicles               | 243        | 179        | 119        | 79         | 61.7%                  |
| Total                        | 256        | 185        | 121        | 81         | 63.3%                  |
| <b>Total</b>                 |            |            |            |            |                        |
| <b>Highway vehicle total</b> | <b>323</b> | <b>244</b> | <b>173</b> | <b>128</b> | <b>100.0%</b>          |
| Percent diesel               | 79.3%      | 75.8%      | 69.9%      | 63.3%      |                        |

**Source:**

U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site  
www.epa.gov/ttn/chieftrends (Additional resources: www.epa.gov/oar/oaqps)

**Note:** Data beyond 2005 are not available.

<sup>a</sup> The sums of subcategories may not equal total due to rounding.

<sup>b</sup> Less than 8,500 pounds.



## EMISSION STANDARDS

The U.S. Environmental Protection Agency (EPA) regulates emissions from mobile sources including vehicles, engines, and motorized equipment that produce exhaust and evaporative emissions. Mobile sources contribute to four main air pollutants: carbon monoxide, hydrocarbons, nitrogen oxides, and particulate matter. The EPA not only sets standards for the vehicles, engines, and equipment, but also the fuels that they use. Tables 12.12 through 12.25 contain summaries of the current standards.

### Acronyms Used on Tables 12.12 through 12.25

|                 |   |
|-----------------|---|
| bhp             | Brake horsepower-hour                                     |
| CI              | Compression-ignition                                      |
| CO              | Carbon Monoxide   |
| DE              | Diesel engine   |
| g               | Gram  |
| g/kN            | Grams per kilonewton                                      |
| g/mi            | Grams per mile  |
| GVW             | Gross vehicle weight                                      |
| HC              | Hydrocarbons  |
| HCHO            | Formaldehyde  |
| HLDT            | Heavy light-duty truck                                    |
| Hp-hr           | Horsepower-hour   |
| kW              | Kilowatt  |
| kW-hr           | Kilowatt-hour   |
| LDT             | Light-duty truck  |
| LDV             | Light-duty vehicle  |
| LEV             | Low-emission vehicle                                      |
| LLDT            | Light light-duty truck                                    |
| LVW             | Loaded vehicle weight                                     |
| MDPV            | Medium-duty passenger vehicle<br>(8,500-10,000 lbs. GVWR) |
| NMHC            | Non-methane hydrocarbon                                   |
| NMOG            | Non-methane organic gases                                 |
| NO <sub>x</sub> | Nitrogen oxides   |
| PM              | Particulate matter  |
| ppm             | Parts per million   |
| rPR             | Rated pressure ratio                                      |
| SI              | Spark-ignition  |
| SULEV           | Super-ultra-low-emission vehicle                          |
| ULEV            | Ultra-low-emission vehicle                                |
| ZEV             | Zero-emission vehicle                                     |



*These exhaust emission standards were phased-in from 2004 to 2010.*

**Table 12.12**  
**Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger Vehicle – Tier 2 Exhaust Emission Standards**

|         | Standard            | Emission Limits at 50,000 Miles |                               |              |              |                  | Emission Limits at Full Useful Life<br>(120,000 miles) <sup>a</sup> |                  |              |              |                  |
|---------|---------------------|---------------------------------|-------------------------------|--------------|--------------|------------------|---|------------------|--------------|--------------|------------------|
|         |                     | NO <sub>x</sub><br>(g/mi)       | NMOG<br>(g/mi)                | CO<br>(g/mi) | PM<br>(g/mi) | HCHO<br>(g/mi)   | NO <sub>x</sub><br>(g/mi)   | NMOG<br>(g/mi)   | CO<br>(g/mi) | PM<br>(g/mi) | HCHO<br>(g/mi)   |
| Federal | Bin 1               | -                               | -                             | -            | -            | -                | 0   | 0                | 0            | 0            | 0                |
|         | Bin 2               | -                               | -                             | -            | -            | -                | 0.02  | 0.01             | 2.1          | 0.01         | 0.004            |
|         | Bin 3               | -                               | -                             | -            | -            | -                | 0.03  | 0.055            | 2.1          | 0.01         | 0.011            |
|         | Bin 4               | -                               | -                             | -            | -            | -                | 0.04  | 0.07             | 2.1          | 0.01         | 0.011            |
|         | Bin 5               | 0.05                            | 0.075                         | 3.4          | -            | 0.015            | 0.07  | 0.09             | 4.2          | 0.01         | 0.018            |
|         | Bin 6               | 0.08                            | 0.075                         | 3.4          | -            | 0.015            | 0.1   | 0.09             | 4.2          | 0.01         | 0.018            |
|         | Bin 7               | 0.11                            | 0.075                         | 3.4          | -            | 0.015            | 0.15  | 0.09             | 4.2          | 0.02         | 0.018            |
|         | Bin 8               | 0.14                            | 0.100 /<br>0.125 <sup>c</sup> | 3.4          | -            | 0.015            | 0.2   | 0.125 /<br>0.156 | 4.2          | 0.02         | 0.018            |
|         | Bin 9 <sup>b</sup>  | 0.2                             | 0.075 /<br>0.140              | 3.4          | -            | 0.015            | 0.3   | 0.090 /<br>0.180 | 4.2          | 0.06         | 0.018            |
|         | Bin 10 <sup>b</sup> | 0.4                             | 0.125 /<br>0.160              | 3.4 /<br>4.4 | -            | 0.015 /<br>0.018 | 0.6   | 0.156 /<br>0.230 | 4.2 /<br>6.4 | 0.08         | 0.018 /<br>0.027 |
|         | Bin 11 <sup>b</sup> | 0.6                             | 0.195                         | 5            | -            | 0.022            | 0.9   | 0.28             | 7.3          | 0.12         | 0.032            |

**Source:**

40 CR 86 Subpart S. (Additional resources: [www.epa.gov/otaq/standards](http://www.epa.gov/otaq/standards))

**Note:** Tests Covered: Federal Test Procedure (FTP), cold carbon monoxide, highway, and idle. Definitions of acronyms are on page 12-13.

<sup>a</sup> In lieu of intermediate useful life standards (50,000 miles) or to gain additional nitrogen oxides credit, manufacturers may optionally certify to the Tier 2 exhaust emission standards with a useful life of 150,000 miles.

<sup>b</sup> Bins 9-11 expired in 2006 for light-duty vehicles and light light-duty trucks and 2008 for heavy light-duty trucks and medium-duty passenger vehicles.

<sup>c</sup> Pollutants with two numbers have a separate certification standard (1st number) and in-use standard (2nd number).



**Table 12.13**  
**Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger Vehicle – Tier 2 Evaporative Emission Standards**

|         |                        |               | 3 Day Diurnal<br>+ Hot Soak<br>(g/test) | Supplemental<br>2 Day Diurnal<br>+ Hot Soak<br>(g/test) | Running<br>Loss<br>(g/mi) |
|---------|------------------------|---------------|---|---|---------------------------|
|         | Vehicle Type           | Model<br>Year |   |   |                           |
| Federal | LDV/LLDTs <sup>a</sup> | 2004          | 0.95                                    | 1.20  | 0.05                      |
|         | HLDTs <sup>b</sup>     | 2004          | 1.20                                    | 1.50  | 0.05                      |
|         | MDPVs <sup>a, b</sup>  | 2004          | 1.40                                    | 1.75  | 0.05                      |
|         | LDV <sup>a</sup>       | 2009          | 0.50                                    | 0.65  | 0.05                      |
|         | LLDT <sup>a</sup>      | 2009          | 0.65                                    | 0.85  | 0.05                      |
|         | HLDT <sup>b</sup>      | 2010          | 0.90                                    | 1.15  | 0.05                      |
|         | MDPV <sup>a, b</sup>   | 2010          | 1.00                                    | 1.25  | 0.05                      |

**Source:**

40 CR 86 Subpart S. (Additional resources: [www.epa.gov/otaq/standards](http://www.epa.gov/otaq/standards))

**Note:** Multi-fuel vehicle phase-in applies. Definitions of acronyms are on page 12-13.

<sup>a</sup> For liquefied petroleum gas-fueled light-duty vehicles (LDV), light-duty trucks (LDT), and medium-duty passenger vehicles (MDPV): 0.15 grams hydrocarbon per gallon (0.04 grams per liter) of fuel dispensed.

<sup>b</sup> Refueling standards for heavy light-duty trucks (HLDT) are subject to phase-in requirements. MDPVs must also comply with the phase-in requirement and must be grouped with HLDTs to determine phase-in compliance.



**Table 12.14**  
**Heavy-Duty Highway Compression-Ignition Engines and Urban Buses – Exhaust**  
**Emission Standards**

|                      | Year                      | HC<br>(g/bhp-hr) | NMHC<br>(g/bhp-hr) | NMHC + NOx<br>(g/bhp-hr)   | NOx<br>(g/bhp-hr) | PM<br>(g/bhp-hr)                                   | CO<br>(g/bhp-hr) | Idle CO<br>(percent Exhaust gas flow) | Smoke <sup>a</sup><br>(Percentage) | Useful Life<br>(hours/years/miles)  |
|----------------------|---------------------------|------------------|--------------------|--|-------------------|--|------------------|---------------------------------------|------------------------------------|---|
| Federal <sup>b</sup> | 1974-78                   | -                | -                  | 16   | -                 | -  | 40               | -                                     | 20 / 15 / 50                       | -   |
|                      | 1979-84                   | 1.5              | -                  | 10   | -                 | -  | 25               | -                                     | 20 / 15 / 50                       | -   |
|                      | 1985-87                   | 1.3              | -                  | -  | 10.7              | -  | 15.5             | -                                     | 20 / 15 / 50                       | LHDDE: - / 8 / 110,000<br>MHDDE: - / 8 / 185,000<br>HHDDE: - / 8 / 290,000  |
|                      | 1988-89                   | 1.3 <sup>d</sup> | -                  | -  | 10.7              | 0.6  | 15.5             | 0.5 <sup>c</sup>                      | 20 / 15 / 50                       | 1990-97 and 1998+ for<br>HC, CO, and PM:<br>LHDDE: - / 8 / 110,000<br>MHDDE: - / 8 / 185,000<br>HHDDE: - / 8 / 290,000  |
|                      | 1990                      | 1.3 <sup>d</sup> | -                  | -  | 6.0               | 0.6  | 15.5             | 0.5 <sup>c</sup>                      | 20 / 15 / 50                       |   |
|                      | 1991-93                   | 1.3              | -                  | -  | 5.0 [ABT]         | 0.25 [ABT]<br>0.10 <sup>e</sup>                    | 15.5             | 0.5 <sup>c</sup>                      | 20 / 15 / 50                       | 1994+ urban buses for PM<br>only:<br>LHDDE: - / 10 / 110,000<br>1998+ for NOx:<br>LHDDE: - / 10 / 110,000<br>MHDDE: - / 10 / 185,000<br>HHDDE: - / 10 / 290,000 |
|                      | 1994-97                   | 1.3              | -                  | -  | 5.0 [ABT]         | 0.1 [ABT]<br>0.07 <sup>f</sup> , 0.05 <sup>g</sup> | 15.5             | 0.5 <sup>c</sup>                      | 20 / 15 / 50                       |   |
|                      | 1998-2003                 | 1.3              | -                  | -  | 4.0 [ABT]         | 0.1 [ABT]<br>0.05 <sup>g</sup>                     | 15.5             | 0.5 <sup>c</sup>                      | 20 / 15 / 50                       |   |
|                      | 2004-2006 <sup>h</sup>    | -                | -                  | 2.4 (or 2.5<br>with a limit of<br>0.5 on<br>NMHC) <sup>o</sup><br>[ABT] <sup>j</sup> | -                 | 0.1<br>0.05 <sup>h</sup>                           | 15.5             | 0.5                                   | 20 / 15 / 50                       | For all pollutants: <sup>p</sup><br>LHDDE: - / 10 / 110,000<br>MHDDE: - / 10 / 185,000<br>HHDDE: 22,000 / 10 /<br>435,000                                       |
|                      | 2007 <sup>h,k,l,m,n</sup> | -                | 0.14 <sup>o</sup>  | 2.4 (or 2.5<br>with a limit of<br>0.5 on NMHC)<br>[ABT]                              | 0.2 <sup>o</sup>  | 0.01   | 15.5             | 0.5                                   | 20 / 15 / 50                       |   |

**Sources:**

40 CFR 86.099-11 Emission standards for 1999 and later model year diesel heavy-duty engines and vehicles.

40 CFR 86.004-11 Emission standards for 2004 and later model year diesel heavy-duty engines and vehicles.

40 CFR 86.007-11 Emission standards and supplemental requirements for 2007 and later model year diesel heavy-duty engines and vehicles. (Additional resources: [www.epa.gov/otaq/standards](http://www.epa.gov/otaq/standards))

**Note:** The test procedures are the EPA Transient Test Procedure and the EPA Smoke Test Procedure. Definitions of acronyms are on page 12-13.

<sup>a</sup> Percentages apply to smoke opacity at acceleration/lug/peak modes.

<sup>b</sup> Standards for 1990 apply only to diesel-fueled heavy-duty engines (HDE). Standards for 1991+ apply to both diesel- and methanol-fueled HDEs. Standards that apply to urban buses specifically are footnoted.

<sup>c</sup> This standard applies to the following fueled engines for the following model years: methanol - 1990+, natural gas and liquefied petroleum gas (LPG) - 1994+.

<sup>d</sup> For petroleum-fueled engines, the standard is for hydrocarbons (HC). For methanol-fueled engines, the standard is for total hydrocarbon equivalent (THCE).

<sup>e</sup> Certification standard for urban buses for 1993.

<sup>f</sup> Certification standard for urban buses from 1994-95.

<sup>g</sup> Certification standard for urban buses from 1996 and later. The in-use standard is 0.07.

<sup>h</sup> Load Response Test certification data submittal requirements take effect for heavy-duty diesel engines beginning in model year 2004. The following requirements take effect with the 2007 model year: steady-state test requirement and Not-to-Exceed (NTE) test procedures for testing of in-use engines. On-board diagnostic requirements applicable to heavy-duty diesel vehicles and engines up to 14,000 pounds gross vehicle weight rating (GVWR) phase in from the 2005 through 2007 model years.



**Table 12.14 (continued)**  
**Heavy-Duty Highway Compression-Ignition Engines and Urban Buses – Exhaust**  
**Emission Standards**

<sup>i</sup> The modified averaging, banking, and trading program for 1998 and later model year engines applies only to diesel cycle engines. Credits generated under the modified program may be used only in 2004 and later model years.

<sup>j</sup> For heavy-duty diesel engines, there are three options to the measurement procedures currently in place for alternative fueled engines: (1) use a THC measurement in place of a non-methane hydrocarbon (NMHC) measurement; (2) use a measurement procedure specified by the manufacturer with prior approval of the Administrator; or (3) subtract two percent from the measured THC value to obtain an NMHC value. The methodology must be specified at time of certification and will remain the same for the engine family throughout the engines' useful life. For natural gas vehicles, EPA allows the option of measuring NMHC through direct quantification of individual species by gas chromatography.

<sup>k</sup> Starting in 2006, refiners must begin producing highway diesel fuel that meets a maximum sulfur standard of 15 parts per million (ppm).

<sup>l</sup> Subject to a Supplemental Emission Test (1.0 x Federal Test Procedure [FTP] standard (or Family Emission Limit [FEL]) for nitrogen oxides [NO<sub>x</sub>], NMHC, and particulate matter [PM]) and a NTE test (1.5 x FTP standard [or FEL] for NO<sub>x</sub>, NMHC, and PM).

<sup>m</sup> EPA adopted the lab-testing and field-testing specifications in 40 CFR Part 1065 for heavy-duty highway engines, including both diesel and Otto-cycle engines. These procedures replace those previously published in 40 Code of Federal Regulations (CFR) Part 86, Subpart N. Any new testing for 2010 and later model years must be done using the 40 CFR Part 1065 procedures.

<sup>n</sup> Two-phase in-use NTE testing program for heavy-duty diesel vehicles. The program begins with the 2007 model year for gaseous pollutants and 2008 for PM. The requirements apply to diesel engines certified for use in heavy-duty vehicles (including buses) with GVWRs greater than 8,500 pounds. However, the requirements do not apply to any heavy-duty diesel vehicle that was certified using a chassis dynamometer, including medium-duty passenger vehicles with GVWRs of between 8,500 and 10,000 pounds.

<sup>o</sup> NO<sub>x</sub> and NMHC standards will be phased in together between 2007 and 2010. The phase-in will be on a percent-of-sales basis: 50 percent from 2007 to 2009 and 100 percent in 2010.

<sup>p</sup> Note that for an individual engine, if the useful life hours interval is reached before the engine reaches 10 years or 100,000 miles, the useful life shall become 10 years or 100,000 miles, whichever occurs first, as required under Clean Air Act section 202(d).



**Table 12.15**  
**Heavy-Duty Highway Spark-Ignition Engines – Exhaust Emission Standards**

|         | Engine or Vehicle                            | Year                   | Gross Vehicle Weight (lbs) | HC <sup>a</sup> (g/bhp-hr) | NMHC <sup>b</sup> (g/bhp-hr) | NOx (g/bhp-hr)   | NOx + NMHC <sup>c</sup> (g/bhp-hr) | PM (g/bhp-hr) | CO (g/bhp-hr) | Idle CO (% exhaust gas flow) | Formaldehyde | Useful Life (years / miles) |
|---------|--|------------------------|----------------------------|----------------------------|------------------------------|------------------|------------------------------------|---------------|---------------|------------------------------|--------------|-----------------------------|
| Federal | Heavy Duty Engines <sup>d</sup>              | Prior to Control       | -                          | 12.7                       | -                            | -                | 6.86                               | -             | 155           | -                            | -            | 5 / 50,000                  |
|         |  | 1970-73                | -                          | 275 ppm                    | -                            | -                | -                                  | -             | 1.50%         | -                            | -            |                             |
|         |  | 1974-78                | -                          | -                          | -                            | 16               | -                                  | -             | 40            | -                            | -            |                             |
|         |  | 1979-84                | -                          | 1.5                        | -                            | 10               | -                                  | -             | 25            | -                            | -            |                             |
|         |  | 1985-86                | -                          | 1.9                        | -                            | -                | 10.6                               | -             | 37.1          | -                            | -            |                             |
|         |  | 1987                   | 14,000                     | 1.1                        | -                            | -                | 10.6                               | -             | 14.4          | 0.5                          | -            |                             |
|         |  |                        | > 14,000                   | 1.9                        | -                            | -                | 10.6                               | -             | 37.1          |                              | -            |                             |
|         |  | 1988-90                | 14,000                     | 1.1                        | -                            | -                | 6.0                                | -             | 14.4          | -                            | -            |                             |
|         |  |                        | > 14,000                   | 1.9                        | -                            | -                | 6.0                                | -             | 37.1          | -                            | -            |                             |
|         |  | 1990 <sup>e</sup>      | 14,000                     | 1.1                        | -                            | -                | 6.0                                | -             | 14.4          | 0.5 <sup>j</sup>             | -            | 8 / 110,000 <sup>k</sup>    |
|         |  |                        | > 14,000                   | 1.9                        | -                            | -                | 6.0                                | -             | 37.1          |                              | -            |                             |
|         |  | 1991-97 <sup>f</sup>   | 14,000                     | 1.1 <sup>g</sup>           | -                            | -                | 5.0                                | -             | 14.4          |                              | -            |                             |
|         |  |                        | > 14,000                   | 1.9 <sup>h</sup>           | -                            | -                | 5.0                                | -             | 37.1          |                              | -            |                             |
|         |  | 1998-2004 <sup>f</sup> | 14,000                     | 1.1 <sup>g</sup>           | -                            | -                | 4.0 <sup>i</sup>                   | -             | 14.4          |                              | -            |                             |
|         |  |                        | > 14,000                   | 1.9 <sup>h</sup>           | -                            | -                |                                    | -             | 37.1          |                              | -            |                             |
|         |  | 2005-2007 <sup>f</sup> | 14,000                     | 1.1 <sup>g</sup>           | -                            | 1.0 <sup>j</sup> | -                                  | -             | 14.4          |                              | -            | 10 / 110,000                |
|         |  |                        | > 14,000                   | 1.9 <sup>h</sup>           | -                            |                  | -                                  | -             | 37.1          |                              | -            |                             |
|         |  | 2008+                  | All                        | -                          | 0.14                         | 0.2              | -                                  | 0.01          | 14.4          |                              | -            | 11 / 110,000                |
|         | Complete Heavy-Duty Vehicles <sup>h, q</sup> | 2005-2007              | 8,500 - 10,000             | -                          | 0.280 <sup>m</sup>           | -                | 0.9                                | -             | 7.3           |                              | -            |                             |
|         |  |                        | 10,000 - 14,000            | -                          | 0.330 <sup>m</sup>           | -                | 1.0                                | -             | 8.1           |                              | -            |                             |
|         |  | 2008+ <sup>p</sup>     | 8,500 - 10,000             | -                          | 0.195 <sup>o</sup>           | -                | 0.2                                | 0.02          | 7.3           |                              | 0.032        |                             |
|         |  |                        | 10,000 - 14,000            | -                          | 0.230 <sup>o</sup>           | -                | 0.4                                | 0.02          | 8.1           |                              | 0.04         |                             |

**Sources:**

40 CFR 86.1816-05, 86.1816-08 Emission standards for complete heavy-duty vehicles

40 CFR 86.1806-01, 86.1806-04, 86.1806-05 Onboard diagnostics requirements

40 CFR 86.1817-05, 86.1817-08 Complete heavy-duty vehicle averaging, banking, and trading program

40 CFR 86.091-10 Heavy-duty engine averaging, banking, and trading program for 1991 and later - Not available in the e-CFR

40 CFR Part 86 Subpart B Vehicle test procedures (Additional resources: [www.epa.gov/otaq/standards](http://www.epa.gov/otaq/standards))

**Note:** Definitions of acronyms are on page 12-13.

<sup>a</sup> For methanol-fueled engines, the standard is for total hydrocarbon equivalent (THCE).

<sup>b</sup> For methanol and alcohol fueled vehicles the standard is for non-methane hydrocarbon equivalent (NMHCE).

<sup>c</sup> For methanol fueled engines the standard is for nitrogen oxides (NOx) plus NMHCE.

<sup>d</sup> Standards for heavy-duty engines are expressed in grams per brake horsepower-hour (g/bhp-hr). Starting with the 1998 model year, crankcase emissions are not allowed.

<sup>e</sup> Standards for 1990 apply to gasoline and methanol-fueled engines.

<sup>f</sup> Standards for 1991 and later apply to gasoline and methanol engines and are optional for natural gas and Liquefied Petroleum Gas-fueled engines through the 1996 model year.

<sup>g</sup> For natural gas fueled engines the standard is 0.9 g/bhp-hr non-methane hydrocarbon (NMHC).





**Table 12.15 (continued)**  
**Heavy-Duty Highway Spark-Ignition Engines – Exhaust Emission Standards**

<sup>h</sup> For natural gas fueled engines the standard is 1.7 g/bhp-hr NMHC.

<sup>i</sup> The NO<sub>x</sub> standard is 5.0 for all natural gas-fueled engines.

<sup>j</sup> This standard applies to the following engines utilizing aftertreatment technology (except for methanol) for the following model years: gasoline/1990+; natural gas and LPG/1991+; methanol/1990+. Starting in 2005, engines certified to on-board diagnostics requirements are not required to meet the idle carbon monoxide (CO) standard.

<sup>k</sup> Useful life is expressed in years or miles, whichever comes first. Useful life for the 1998 and later NO<sub>x</sub> standard and for all 2004 standards is 10 years or 110,000 miles, whichever comes first.

<sup>l</sup> Manufacturers can choose this standard or one of the following options: (1) a standard of 1.5 g/bhp-hr NMHC+NO<sub>x</sub> that applies to the 2004 through 2007 model years, with complete heavy-duty vehicle standards taking effect in 2005; or (2) a standard of 1.5 g/bhp-hr NMHC + NO<sub>x</sub> that would apply to the 2003 through 2007 heavy-duty engines and optionally to 2003 through 2006 complete heavy-duty vehicles.

<sup>m</sup> Standard is expressed as non-methane organic gas, but compliance can optionally be shown using measurement of NMHC or total hydrocarbon (THC).

<sup>n</sup> Complete heavy-duty vehicles have the primary load-carrying container or device attached. Incomplete heavy-duty vehicles are certified to heavy-duty engine standards. Standards for complete heavy-duty vehicles are expressed in grams per mile (g/mi). Starting in 2005 (or 2003 or 2004 depending on the selected phase in option; see footnote l), complete heavy-duty vehicles under 14,000 lbs gross vehicle weight are tested on chassis-based rather than engine-based procedures and must meet these complete heavy-duty vehicle standards.

<sup>o</sup> Although expressed as NMHC, compliance can optionally be shown using measurement of NMOG or THC.

<sup>p</sup> At least 50 percent of a manufacturer's sales must meet these standards in 2008, with 100 percent required in 2009.

<sup>q</sup> Gross vehicle weight ranges are more accurately specified as follows: 8,500 GVW 10,000 and 10,000 < GVW < 14,000.



**Table 12.16**  
**Heavy-Duty Highway Compression-Ignition and Spark-Ignition Engines – Evaporative Emission Standards**

|         | Engine Type | Year                              | Gross Vehicle Weight (lbs) | Conventional Diurnal + Hot Soak (g/test) <sup>a</sup> | Three-Diurnal Test Sequence (g/test) <sup>b</sup> | Supplemental Two-Diurnal Test Sequence (g/test) <sup>c</sup> | Running Loss (gpm) <sup>c</sup> | Spitback (g/test) <sup>c</sup> | Useful Life <sup>d</sup>   |
|---------|-------------|-----------------------------------|----------------------------|---|---|--|---------------------------------|--------------------------------|--|
| Federal | SI          | 1991-95                           | 14,000                     | 3.0   | -   | -  | -                               | -                              | 8 / 110,000  |
|         |             |                                   | > 14,000 <sup>e</sup>      | 4.0   | -   | -  | -                               | -                              |  |
|         |             | 1996-2007 (Enhanced) <sup>f</sup> | 14,000                     | -   | 3.0   | 3.5  | 0.05                            | 1.0                            | 10 / 120,000   |
|         |             |                                   | > 14,000 <sup>e</sup>      | -   | 4.0   | 4.5  |                                 | -                              |  |
|         |             | 2008+ (Enhanced)                  | 8500-14,000                | -   | 1.4   | 1.75   |                                 | 1.0                            | 11 / 110,000   |
|         |             |                                   | > 14,000 <sup>e</sup>      | -   | 1.9   | 2.3  |                                 | -                              |  |
|         | CI          | 1996-97                           | 14,000                     | -   | 3.0   | -  | -                               | -                              | MHDDE: 8 / 185,000<br>HHDDE: 8 / 290,000<br>MHDDE: 8 / 185,000<br>HHDDE: 8 / 290,000 |
|         |             |                                   | > 14,000 <sup>e</sup>      | -   | 4.0   | -  | -                               | -                              |  |
|         |             | 1998+ (Enhanced) <sup>g</sup>     | 14,000                     | -   | 3.0   | 3.5  | 0.05                            | 1.0                            |  |
|         |             |                                   | > 14,000 <sup>e</sup>      | -   | 4.0   | 4.5  |                                 | -                              |  |

**Sources:**

40 CFR 86.099-11 Emission standards for 1999 and later model year diesel heavy-duty engines and vehicles.

40 CFR 86.004-11 Emission standards for 2004 and later model year diesel heavy-duty engines and vehicles.

CFR 86.007-11 Emission standards and supplemental requirements for 2007 and later model year diesel heavy-duty engines and vehicles. (Additional resources: [www.epa.gov/otaq/standards](http://www.epa.gov/otaq/standards))

**Note:** Definitions of acronyms are on page 12-13.

<sup>a</sup> Applies to gasoline and methanol engines. Standard is hydrocarbon (HC) for gasoline engines, total hydrocarbon equivalent (THCE) for methanol engines.

<sup>b</sup> For spark-ignition (SI) engines, standard applies to gasoline, methanol, natural gas, and liquefied petroleum gas engines. For compression-ignition (CI) engines, standard applies to methanol, natural gas, and liquefied petroleum gas engines. Standard is THCE for methanol engines, HC for others.

<sup>c</sup> For SI engines, standard applies to gasoline and methanol engines. For CI engines, standard applies to methanol engines. Standard is THCE for methanol engines, HC for others.

<sup>d</sup> Useful life is expressed in years or miles, whichever comes first.

<sup>e</sup> Vehicles over 26,000 pounds gross vehicle weight may demonstrate compliance with an engineering design evaluation in lieu of testing.

<sup>f</sup> A new enhanced evaporative test procedure applies, which is considerably more stringent than the previous test procedure despite the fact that the standard values do not change from prior years. Gasoline and methanol engines are phased in at the following rates of a manufacturer's sales for the specified model year: 1996: 20 percent; 1997: 40 percent; 1998: 90 percent; 1999: 100 percent.

<sup>g</sup> A new enhanced evaporative test procedure applies, which is considerably more stringent than the previous test procedure despite the fact that the standard values do not change from prior years. Methanol-fueled vehicles are phased in at a rate of 90 percent of a manufacturer's production in 1998 and 100 percent in 1999.



**Table 12.17**  
**California Car, Light Truck and Medium Truck Emission Certification Standards**

| Vehicle Type  | Durability<br>Vehicle<br>Basis (mi) | Vehicle<br>Emission<br>Category | NMOG<br>(g/mi) | Carbon<br>Monoxide<br>(g/mi) | Oxides of<br>Nitrogen<br>(g/mi) | Formaldehyde<br>(mg/mi) | Particulates<br>(g/mi) |
|---|-------------------------------------|---------------------------------|----------------|------------------------------|---------------------------------|-------------------------|------------------------|
| All passenger cars;<br>LDTs 8,500 lbs GVW or<br>less<br><br>Vehicles in this category<br>are tested at their loaded<br>vehicle weight | 50,000                              | LEV                             | 0.075          | 3.4                          | 0.05                            | 15                      | n/a                    |
|   |                                     | LEV, Option 1                   | 0.075          | 3.4                          | 0.07                            | 15                      | n/a                    |
|   |                                     | ULEV                            | 0.040          | 1.7                          | 0.05                            | 8                       | n/a                    |
|   | 120,000                             | LEV                             | 0.090          | 4.2                          | 0.07                            | 18                      | 0.01                   |
|   |                                     | LEV, Option 1                   | 0.090          | 4.2                          | 0.10                            | 18                      | 0.01                   |
|   |                                     | ULEV                            | 0.055          | 2.1                          | 0.07                            | 11                      | 0.01                   |
|   |                                     | SULEV                           | 0.010          | 1.0                          | 0.02                            | 4                       | 0.01                   |
|   | 150,000<br>(Optional)               | LEV                             | 0.090          | 4.2                          | 0.07                            | 18                      | 0.01                   |
|   |                                     | LEV, Option 1                   | 0.090          | 4.2                          | 0.10                            | 18                      | 0.01                   |
|   |                                     | ULEV                            | 0.055          | 2.1                          | 0.07                            | 11                      | 0.01                   |
|   |                                     | SULEV                           | 0.010          | 1.0                          | 0.02                            | 4                       | 0.01                   |
| MDVs<br>8,501-10,000 lbs GVW<br><br>Vehicles in this category<br>are tested at their<br>adjusted loaded vehicle<br>weight             | 120,000                             | LEV                             | 0.195          | 6.4                          | 0.2                             | 32                      | 0.12                   |
|   |                                     | ULEV                            | 0.143          | 6.4                          | 0.2                             | 16                      | 0.06                   |
|   |                                     | SULEV                           | 0.100          | 3.2                          | 0.1                             | 8                       | 0.06                   |
|   | 150,000<br>(Optional)               | LEV                             | 0.195          | 6.4                          | 0.2                             | 32                      | 0.12                   |
|   |                                     | ULEV                            | 0.143          | 6.4                          | 0.2                             | 16                      | 0.06                   |
|   |                                     | SULEV                           | 0.100          | 3.2                          | 0.1                             | 8                       | 0.06                   |
| MDVs<br>10,000-14,000 lbs GVW<br><br>Vehicles in this category<br>are tested at their<br>adjusted loaded vehicle<br>weight            | 120,000                             | LEV                             | 0.230          | 7.3                          | 0.4                             | 40                      | 0.12                   |
|   |                                     | ULEV                            | 0.167          | 7.3                          | 0.4                             | 21                      | 0.06                   |
|   |                                     | SULEV                           | 0.117          | 3.7                          | 0.2                             | 10                      | 0.06                   |
|   | 150,000<br>(Optional)               | LEV                             | 0.230          | 7.3                          | 0.4                             | 40                      | 0.12                   |
|   |                                     | ULEV                            | 0.167          | 7.3                          | 0.4                             | 21                      | 0.06                   |
|   |                                     | SULEV                           | 0.117          | 3.7                          | 0.2                             | 10                      | 0.06                   |

**Source:**

California LEV Regulations with amendments effective 12/8/10. (Additional resources: [www.arb.ca.gov](http://www.arb.ca.gov))

**Note:** Definitions of acronyms are on page 12-13.



*These exhaust emission standards apply to commercial aircraft engines.*

**Table 12.18**  
**Aircraft – Exhaust Emission Standards**

|                      | Year  | Pressure Ratio (PR) | Applicability <sup>a</sup>                         | HC (g/kN)               | NO <sub>x</sub>                               | CO (g/kN) | Smoke  |
|----------------------|-------|---------------------|--|-------------------------|---|-----------|--|
| Federal <sup>b</sup> | 1974+ | -                   | T8   | -                       | -   | -         | 30   |
|                      | 1976+ | -                   | TF with rO <sup>c</sup> 129 kN                     | -                       | -   | -         | 83.6(rO) <sup>-0.274</sup>                     |
|                      | 1978+ | -                   | T3 <sup>d</sup>                                    | -                       | -   | -         | 25   |
|                      | 1983+ | -                   | TF with rO < 26.7 kN                               | -                       | -   | -         | 83.6(rO) <sup>-0.274</sup> NTE<br>max of SN=50 |
|                      | 1984+ | -                   | T3, T8, TF with rO 26.7 kN                         | 19.6                    | -   | -         | 83.6(rO) <sup>-0.274</sup> NTE<br>max of SN=50 |
|                      |       | -                   | TSS  | 140(.92) <sup>rPR</sup> | -   | -         | 83.6(rO) <sup>-0.274</sup> NTE<br>max of SN=50 |
|                      |       | -                   | TSS with rO 26.7 kN                                | 140(.92) <sup>rPR</sup> | -   | -         | 83.6(rO) <sup>-0.274</sup> NTE<br>max of SN=50 |
|                      |       | -                   | TP with rO 1,000 kW                                | -                       | -   | -         | 187(rO) <sup>-0.168</sup>                      |
|                      | 1997+ | -                   | T3, T8, TF with rO > 26.7 kN                       | 19.6                    | 40+2(rPR)                                     | 118       | 83.6(rO) <sup>-0.274</sup> NTE<br>max of SN=50 |
|                      |       | -                   | T3, T8, TF newly certified with rO > 26.7 kN       | 19.6                    | 32+1.6(rPR)                                   | 118       | 83.6(rO) <sup>-0.274</sup> NTE<br>max of SN=50 |
|                      | 2000+ | -                   | T3, T8, TF newly manufactured with rO > 26.7 kN    | 19.6                    | 32+1.6(rPR)                                   | 118       | 83.6(rO) <sup>-0.274</sup> NTE<br>max of SN=50 |
|                      | 2005+ | PR 30               | T3, T8, TF newly certified with rO > 89 kN         | -                       | 19+1.6(rPR)                                   | -         | -  |
|                      |       |                     | T3, T8, TF newly certified with 26.7 kN < rO 89 kN | -                       | 37.572+1.6(rPR)-0.2087(rO)                    | -         | -  |
|                      |       | 30 < PR < 62.5      | T3, T8, TF newly certified with rO>89 kN           | -                       | 7+2.0(rPR)                                    | -         | -  |
|                      |       |                     | T3, T8, TF newly certified with 26.7kN < rO 89kN   | -                       | 42.71+1.4286(rPR)-0.4013(rO)+0.00642(rPR)(rO) | -         | -  |
|                      |       | PR 62.5             | T3, T8, TF   | -                       | 32+1.6(rPR)                                   | -         | -  |

**Source:**

40 CFR Part 87, Aircraft emission standards, test procedures, certification requirements (Additional resources: [www.epa.gov/otaq/standards](http://www.epa.gov/otaq/standards))

**Note:** The test procedures are the International Civil Aviation Organization (ICAO) Smoke Emission Test Procedure and the ICAO Gaseous Emissions Test Procedure. There is no useful life or warranty period for purposes of compliance with aircraft emissions standards. Definitions of acronyms are on page 12-13.

<sup>a</sup> T8=all aircraft gas turbine engines of the JT8D model family

TF=all turbofan and turbojet aircraft engines except engines of Class T3, T8, and TSS

T3=all aircraft gas turbine engines of the JT3D model family

TSS=all aircraft gas turbine engines for aircraft operations at supersonic flight speeds

TP=all aircraft turboprop engines

<sup>b</sup> Federal standards apply to planes operating in the United States, regardless of where they were manufactured.

<sup>c</sup> Rated output (rO) is the maximum power/thrust available for takeoff.

<sup>d</sup> T3 engines are no longer manufactured but are in the existing fleet.



*These standards apply to construction and agricultural equipment, such as excavators, paving equipment, tractors, combines, bulldozers, and skidders.*

**Table 12.19**  
**Nonroad Compression-Ignition Engines – Exhaust Emission Standards**

|         | Rated Power (kW) | Tier                      | Model Year             | NMHC (g/kW-hr)   | NMHC + NO <sub>x</sub> (g/kW-hr) | NO <sub>x</sub> (g/kW-hr) | PM (g/kW-hr)      | CO (g/kW-hr) | Smoke <sup>a</sup> Percentage | Useful Life (hours/years) <sup>b</sup> |
|---------|------------------|---------------------------|------------------------|------------------|----------------------------------|---------------------------|-------------------|--------------|-------------------------------|--|
| Federal | kW < 8           | 1                         | 2000-2004              | --               | 10.5                             | --                        | 1.0               | 8.0          | 20 / 15 / 50                  | 3,000 / 5                              |
|         |                  | 2                         | 2005-2007              | --               | 7.5                              | --                        | 0.80              | 8.0          |                               |  |
|         |                  | 4                         | 2008+                  | --               | 7.5                              | --                        | 0.40 <sup>c</sup> | 8.0          |                               |  |
|         | 8 kW < 19        | 1                         | 2000-2004              | --               | 9.5                              | --                        | 0.80              | 6.6          |                               | 3,000 / 5                              |
|         |                  | 2                         | 2005-2007              | --               | 7.5                              | --                        | 0.80              | 6.6          |                               |  |
|         |                  | 4                         | 2008+                  | --               | 7.5                              | --                        | 0.40              | 6.6          |                               |  |
|         | 19 kW < 37       | 1                         | 1999-2003              | --               | 9.5                              | --                        | 0.80              | 5.5          |                               | 5,000 / 7 <sup>d</sup>                 |
|         |                  | 2                         | 2004-2007              | --               | 7.5                              | --                        | 0.60              | 5.5          |                               |  |
|         |                  | 4                         | 2008-2012              | --               | 7.5                              | --                        | 0.30              | 5.5          |                               |  |
|         |                  |                           | 2013+                  | --               | 4.7                              | --                        | 0.03              | 5.5          |                               |  |
|         | 37 kW < 56       | 1                         | 1998-2003              | --               | --                               | 9.2                       | --                | --           |                               | 8,000 / 10                             |
|         |                  | 2                         | 2004-2007              | --               | 7.5                              | --                        | 0.40              | 5.0          |                               |  |
|         |                  | 3 <sup>e</sup>            | 2008-2011              | --               | 4.7                              | --                        | 0.40              | 5.0          |                               |  |
|         |                  | 4 (Option 1) <sup>f</sup> |                        | 2008-2012        | --                               | 4.7                       | --                | 0.30         |                               |  |
|         |                  | 4 (Option 2) <sup>f</sup> |                        | 2012             | --                               | 4.7                       | --                | 0.03         |                               |  |
|         |                  | 4                         | 2013+                  | --               | 4.7                              | --                        | 0.03              | 5.0          |                               |  |
|         | 56 kW < 75       | 1                         | 1998-2003              | --               | --                               | 9.2                       | --                | --           |                               |  |
|         |                  | 2                         | 2004-2007              | --               | 7.5                              | --                        | 0.40              | 5.0          |                               |  |
|         |                  | 3                         | 2008-2011              | --               | 4.7                              | --                        | 0.40              | 5.0          |                               |  |
|         |                  | 4                         | 2012-2103 <sup>g</sup> | --               | 4.7                              | --                        | 0.02              | 5.0          |                               |  |
|         |                  |                           | 2014+ <sup>h</sup>     | 0.19             | --                               | 0.4                       | 0.02              | 5.0          |                               |  |
|         | 75 kW < 130      | 1                         | 1997-2002              | --               | --                               | 9.2                       | --                | --           |                               |  |
|         |                  | 2                         | 2003-2006              | --               | 6.6                              | --                        | 0.3               | 5.0          |                               |  |
|         |                  | 3                         | 2007-2011              | --               | 4.0                              | --                        | 0.3               | 5.0          |                               |  |
|         |                  | 4                         | 2012-2013 <sup>g</sup> | --               | 4.0                              | --                        | 0.02              | 5.0          |                               |  |
|         |                  |                           | 2014+                  | 0.19             | --                               | 0.4                       | 0.02              | 5.0          |                               |  |
|         | 130 kW < 225     | 1                         | 1996-2002              | 1.3 <sup>i</sup> | --                               | 9.2                       | 0.54              | 11.4         |                               |  |
|         |                  | 2                         | 2003-2005              | --               | 6.6                              | --                        | 0.20              | 3.5          |                               |  |
|         |                  | 3                         | 2006-2010              | --               | 4.0                              | --                        | 0.20              | 3.5          |                               |  |
|         |                  | 4                         | 2011-2013 <sup>g</sup> | --               | 4.0                              | --                        | 0.02              | 3.5          |                               |  |
|         |                  |                           | 2014+ <sup>h</sup>     | 0.19             | --                               | 0.4                       | 0.02              | 3.5          |                               |  |
|         | 225 kW < 450     | 1                         | 1996-2000              | 1.3 <sup>i</sup> | --                               | 9.2                       | 0.54              | 11.4         |                               |  |
|         |                  | 2                         | 2001-2005              | --               | 6.4                              | --                        | 0.20              | 3.5          |                               |  |
|         |                  | 3                         | 2006-2010              | --               | 4.0                              | --                        | 0.20              | 3.5          |                               |  |
|         |                  | 4                         | 2011-2013 <sup>g</sup> | --               | 4.0                              | --                        | 0.02              | 3.5          |                               |  |
|         |                  |                           | 2014+ <sup>h</sup>     | 0.19             | --                               | 0.4                       | 0.02              | 3.5          |                               |  |
|         | 450 kW < 560     | 1                         | 1996-2001              | 1.3 <sup>i</sup> | --                               | 9.2                       | 0.54              | 11.4         |                               |  |
|         |                  | 2                         | 2002-2005              | --               | 6.4                              | --                        | 0.20              | 3.5          |                               |  |
|         |                  | 3                         | 2006-2010              | --               | 4.0                              | --                        | 0.20              | 3.5          |                               |  |
|         |                  | 4                         | 2011-2013 <sup>g</sup> | --               | 4.0                              | --                        | 0.02              | 3.5          |                               |  |
|         |                  |                           | 2014+ <sup>h</sup>     | 0.19             | --                               | 0.4                       | 0.02              | 3.5          |                               |  |
|         | 560 kW < 900     | 1                         | 2000-2005              | 1.3 <sup>i</sup> | --                               | 9.2                       | 0.54              | 11.4         |                               |  |
|         |                  | 2                         | 2006-2010              | --               | 6.4                              | --                        | 0.20              | 3.5          |                               |  |
|         |                  | 4                         | 2011-2014              | 0.4              | --                               | 3.5                       | 0.10              | 3.5          |                               |  |
|         |                  |                           | 2015+ <sup>h</sup>     | 0.19             | --                               | 3.5 <sup>j</sup>          | 0.04 <sup>k</sup> | 3.5          |                               |  |



**Table 12.19 (continued)**  
**Nonroad Compression-Ignition Engines – Exhaust Emission Standards**

|         | Rated Power (kW) | Tier | Model Year         | NMHC (g/kW-hr)   | NMHC + NOx (g/kW-hr) | NOx (g/kW-hr)    | PM (g/kW-hr)      | CO (g/kW-hr) | Smoke <sup>a</sup> Percentage | Useful Life (hours/years) <sup>b</sup> |
|---------|------------------|------|--------------------|------------------|----------------------|------------------|-------------------|--------------|-------------------------------|--|
| Federal | kW > 900         | 1    | 2000-2005          | 1.3 <sup>i</sup> | --                   | 9.2              | 0.54              | 11.4         | 20 / 15 / 50                  | 8,000 / 10                             |
|         |                  | 2    | 2006-2010          | --               | 6.4                  | --               | 0.20              | 3.5          |                               |  |
|         |                  | 4    | 2011-2014          | 0.4              | --                   | 3.5 <sup>j</sup> | 0.10              | 3.5          |                               |  |
|         |                  |      | 2015+ <sup>h</sup> | 0.19             | --                   | 3.5 <sup>j</sup> | 0.04 <sup>k</sup> | 3.5          |                               |  |

**Source:**

40 CFR 98.112 = Exhaust emission standards

40 CFR 1039.101 = Exhaust emission standards for after 2014 model year

40 CFR 1039.102 = Exhaust emission standards for model year 2014 and earlier

40 CFR 1039 Subpart F = Exhaust emissions transient and steady state test procedures

40 CFR Part 86 Subpart I = Smoke emission test procedures

40 CFR Part 1065 = Test equipment and emissions measurement procedures (Additional resources: [www.epa.gov/otaq/standards](http://www.epa.gov/otaq/standards))

**Note:** Definitions of acronyms are on page 12-13.

<sup>a</sup> Smoke emissions may not exceed 20 percent during the acceleration mode, 15 percent during the lugging mode, and 50 percent during the peaks in either mode. Smoke emission standards do not apply to single-cylinder engines, constant-speed engines, or engines certified to a PM emission standard of 0.07 grams per kilowatt-hour (g/kW-hr) or lower. Smoke emissions are measured using procedures in 40 CFR Part 86 Subpart I.

<sup>b</sup> Useful life and warranty period are expressed hours and years, whichever comes first.

<sup>c</sup> Hand-startable air-cooled direct injection engines may optionally meet a PM standard of 0.60 g/kW-hr. These engines may optionally meet Tier 2 standards through the 2009 model years. In 2010 these engines are required to meet a PM standard of 0.60 g/kW-hr.

<sup>d</sup> Useful life for constant speed engines with rated speed 3,000 revolutions per minute (rpm) or higher is 5 years or 3,000 hours, whichever comes first.

<sup>e</sup> These Tier 3 standards apply only to manufacturers selecting Tier 4 Option 2. Manufacturers selecting Tier 4 Option 1 will be meeting those standards in lieu of Tier 3 standards.

<sup>f</sup> A manufacturer may certify all their engines to either Option 1 or Option 2 sets of standards starting in the indicated model year. Manufacturers selecting Option 2 must meet Tier 3 standards in the 2008-2011 model years.

<sup>g</sup> These standards are phase-out standards. Not more than 50 percent of a manufacturer's engine production is allowed to meet these standards in each model year of the phase out period. Engines not meeting these standards must meet the final Tier 4 standards.

<sup>h</sup> These standards are phased in during the indicated years. At least 50 percent of a manufacturer's engine production must meet these standards during each year of the phase in. Engines not meeting these standards must meet the applicable phase-out standards.

<sup>i</sup> For Tier 1 engines the standard is for total hydrocarbons.

<sup>j</sup> The NOx standard for generator sets is 0.67 g/kW-hr.

<sup>k</sup> The PM standard for generator sets is 0.03 g/kW-hr.



*These standards apply to gasoline and propane industrial equipment such as forklifts, generators, airport service equipment, compressors and ice-grooming machines.*

**Table 12.20**  
**Nonroad Large Spark-Ignition Engines – Exhaust and Evaporative Emission Standards**

|                      | Tier           | Year      | General Duty-Cycle Standards  |   | Alternative Standards for Severe-Duty Engines |                 | Field Testing Standards          |                  | Useful Life (years/hours) |
|----------------------|----------------|-----------|---|---|---|-----------------|----------------------------------|------------------|---------------------------|
|                      |                |           | HC+NOx <sup>a</sup><br>(g/kW-hr)  | CO<br>(g/kW-hr)   | HC+NOx <sup>a</sup><br>(g/kW-hr)              | CO<br>(g/kW-hr) | HC+NOx <sup>a</sup><br>(g/kW-hr) | CO<br>(g/kW-hr)  |                           |
| Federal <sup>b</sup> | 1 <sup>c</sup> | 2004-2006 | 4.0 <sup>d</sup>  | 50.0  | 4.0 <sup>d</sup>                              | 130.0           | -                                | -                | 7 / 5,000 <sup>e</sup>    |
|                      | 2 <sup>f</sup> | 2007+     | 2.7 <sup>f</sup>  | 4.4 <sup>f</sup>  | 2.7   | 130.0           | 3.8 <sup>f</sup>                 | 6.5 <sup>f</sup> | 7 / 5,000 <sup>e</sup>    |
|                      |                |           | Evaporative Emission Standards (for engines fueled by a volatile liquid fuel) |   |   |                 |                                  |                  |                           |
|                      |                |           | Fuel line permeation  | Nonmetallic fuel lines must meet the permeation specifications of SAE J2260 (November 1996)   |   |                 |                                  |                  |                           |
|                      |                |           | Diurnal emissions   | Evaporative HC emissions may not exceed 0.2 grams per gallon of fuel tank capacity  |   |                 |                                  |                  |                           |
|                      |                |           | Running loss  | Liquid fuel in the fuel tank may not reach boiling during continuous engine operation in the final installation at an ambient temperature of 30°C |   |                 |                                  |                  |                           |
| 5 / -                |                |           |   |   |   |                 |                                  |                  |                           |

**Sources:**

40 CFR 1048.101 = Exhaust emission standards

40 CFR 1048.105 = Evaporative emission standards

40 CFR 1048.110 = Engine diagnostic requirements (Additional resources: [www.epa.gov/otaq/standards](http://www.epa.gov/otaq/standards))

<sup>a</sup> The numerical emission standards for hydrocarbons (HC) must be met based on the following types of hydrocarbon emissions for engines powered by the following fuels: (1) non-methane hydrocarbons (NMHC) for natural gas; (2) total hydrocarbon equivalent (THCE) for alcohol; and (3) total hydrocarbons (THC) for other fuels.

<sup>b</sup> Voluntary Blue Sky standards for large spark-ignition (SI) engines are available. Engines with displacement at or below 1,000 cubic centimeters (cc) and maximum power at or below 30 kilowatts (kW) may be certified under the program for small SI engines.

<sup>c</sup> Emission standards are based on testing over a steady-state duty-cycle.

<sup>d</sup> The Tier 1 HC plus nitrogen oxides (NO<sub>x</sub>) emission standard for in-use testing is 5.4 grams per kW-hour (g/kW-hr).

<sup>e</sup> Useful life is expressed in years and hours, whichever comes first. These are the minimum useful life requirements. For severe-duty engines, the minimum useful life is seven years or 1,500 hours of operation, whichever comes first. A longer useful life in hours is required if: (a) the engine is designed to operate longer than the minimum useful life based on the recommended rebuild interval; or (b) the basic mechanical warranty is longer than the minimum useful life.

<sup>f</sup> Optional engine certification is allowed according to the following formula:  $(\text{HC} + \text{NO}_x) \times \text{CO}^{0.784} \leq 8.57$ . The HC+NO<sub>x</sub> and carbon monoxide (CO) emission levels selected to satisfy this formula, rounded to the nearest 0.1 g/kW-hr, become the emission standards that apply for those engines. One may not select an HC+NO<sub>x</sub> emission standard higher than 2.7 g/kW-hr or a CO emission standard higher than 20.6 g/kW-hr.





**Table 12.21**  
**Locomotives – Exhaust Emission Standards**

|                      | Duty-Cycle <sup>b</sup> | Tier   | Year <sup>c</sup>        | HC <sup>i</sup><br>(g/hp-hr) | NOx<br>(g/bhp-hr)      | PM<br>(g/bhp-hr)        | CO<br>(g/bhp-hr) | Smoke<br>(percentage) <sup>m</sup> | Minimum Useful Life<br>(hours / years / miles) <sup>n</sup> |
|----------------------|-------------------------|--------|--------------------------|------------------------------|------------------------|-------------------------|------------------|------------------------------------|---|
| Federal <sup>a</sup> | Line-haul               | Tier 0 | 1973-1992 <sup>d,e</sup> | 1.0                          | 9.5 [ABT]              | 0.22 [ABT]              | 5.0              | 30 / 40 / 50                       | (7.5 x hp) / 10 / 750,000 <sup>o</sup>                      |
|                      |                         | Tier 1 | 1993-2004 <sup>d,e</sup> | 0.55                         | 7.4 [ABT]              | 0.22 [ABT]              | 2.2              | 25 / 40 / 50                       | (7.5 x hp) / 10 / 750,000 <sup>o</sup>                      |
|                      |                         | Tier 2 | 2005-2011 <sup>d</sup>   | 0.30                         | 5.5 [ABT]              | 0.10 <sup>k</sup> [ABT] | 1.5              | 20 / 40 / 50                       | (7.5 x hp) / 10 / -   |
|                      |                         | Tier 3 | 2012-2014 <sup>f</sup>   | 0.30                         | 5.5 [ABT]              | 0.10 [ABT]              | 1.5              | 20 / 40 / 50                       | (7.5 x hp) / 10 / -   |
|                      |                         | Tier 4 | 2015+ <sup>g</sup>       | 0.14                         | 1.3 [ABT]              | 0.03 [ABT]              | 1.5              | -                                  | (7.5 x hp) / 10 / -   |
|                      | Switch                  | Tier 0 | 1973-2001                | 2.10                         | 11.8 [ABT]             | 0.26 [ABT]              | 8.0              | 30 / 40 / 50                       | (7.5 x hp) / 10 / 750,000 <sup>o</sup>                      |
|                      |                         | Tier 1 | 2002-2004 <sup>h</sup>   | 1.20                         | 11.0 [ABT]             | 0.26 [ABT]              | 2.5              | 25 / 40 / 50                       | (7.5 x hp) / 10 / -   |
|                      |                         | Tier 2 | 2005-2010 <sup>h</sup>   | 0.60                         | 8.1 [ABT]              | 0.13 <sup>i</sup> [ABT] | 2.4              | 20 / 40 / 50                       | (7.5 x hp) / 10 / -   |
|                      |                         | Tier 3 | 2011-2014                | 0.60                         | 5.0 [ABT]              | 0.10 [ABT]              | 2.4              | 20 / 40 / 50                       | (7.5 x hp) / 10 / -   |
|                      |                         | Tier 4 | 2015+                    | 0.14 <sup>j</sup>            | 1.3 <sup>j</sup> [ABT] | 0.03 [ABT]              | 2.4              | -                                  | (7.5 x hp) / 10 / -   |

**Sources:**

40 CFR 1033.101 = Emission Standards and Useful Life

<sup>a</sup> These standards apply to locomotives that are propelled by engines with total rated horsepower (hp) of 750 kilowatts (kW) (1006 hp) or more, unless the owner chooses to have the equipment certified to meet the requirements of locomotives. This does not include vehicles propelled by engines with total rated horsepower of less than 750 kW (1006 hp); see the requirements in 40 Code of Federal Regulations (CFR) Parts 86, 89 and 1039. The test procedures specify chassis-based testing of locomotives. These test procedures include certification testing, production line testing, and in-use testing using the Federal Test Procedure (FTP) when the locomotive has reached between 50-70 percent of its useful life.

<sup>b</sup> Line-haul locomotives are powered by an engine with a maximum rated power (or a combination of engines having a total rated power) greater than 2300 hp. Switch locomotives are powered by an engine with a maximum rated power (or a combination of engines having a total rated power) of 2300 hp or less.

<sup>c</sup> The Tier 0 standards apply to locomotives manufactured after 1972 when they are manufactured or remanufactured. Note that interim standards may apply for Tier 0 or Tier 1 locomotives remanufactured in 2008 or 2009, or for Tier 2 locomotives manufactured or remanufactured in 2008-2012.

<sup>d</sup> Line-haul locomotives subject to the Tier 0 through Tier 2 emission standards must also meet switch standards of the same tier.

<sup>e</sup> The Tier 0 standards apply for 1993-2001 locomotives not originally manufactured with a separate loop intake air cooling system.

<sup>f</sup> Tier 3 line-haul locomotives must also meet Tier 2 switch standards.

<sup>g</sup> Manufacturers using credits may elect to meet a combined nitrogen oxides (NOx) plus hydrocarbon (HC) standard of 1.4 grams per brakehorsepower-hour (g/bhp-hr) instead of the otherwise applicable Tier 4 NOx and HC standards.

<sup>h</sup> Tier 1 and Tier 2 switch locomotives must also meet line-haul standards of the same tier.

<sup>i</sup> The numerical emission standards for HC must be met based on the following types of hydrocarbon emissions for locomotives powered by the following fuels: (1) alcohol: total hydrocarbon equivalent (THCE) emissions for Tier 3 and earlier locomotives, and non-methane hydrocarbon equivalent (NMHCE) for Tier 4; (2) natural gas and liquefied petroleum gas: non-methane hydrocarbon (NMHC) emissions; and (3) diesel: total hydrocarbon (THC) emissions for Tier 3 and earlier locomotives, and NMHC for Tier 4.





**Table 12.21 (continued)**  
**Locomotives – Exhaust Emission Standards**

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<sup>j</sup> Manufacturers may elect to meet a combined NO<sub>x</sub>+HC standard of 1.4 g/bhp-hr instead of the otherwise applicable Tier 4 NO<sub>x</sub> and HC standards.

<sup>k</sup> The line-haul particulate matter (PM) standard for newly remanufactured Tier 2 locomotives is 0.20 g/bhp-hr until January 1, 2013, except as specified in 40 CFR Part 1033.150(a).

<sup>l</sup> The switch PM standard for new Tier 2 locomotives is 0.24 g/bhp-hr until January 1, 2013, except as specified in 40 CFR Part 1033.150(a).

<sup>m</sup> The smoke opacity standards apply only for locomotives certified to one or more PM standards or Family Emission Limits (FEL) greater than 0.05 g/bhp-hr. Percentages apply to smoke opacity at steady state/30-second peak/3-second peak, as measured continuously during testing.

<sup>n</sup> Useful life and warranty period are expressed in megawatt-hours (mw-hr), years, or miles, whichever comes first. Manufacturers are required to certify to longer useful lives if their locomotives are designed to last longer between overhauls than the minimum useful life value.

<sup>o</sup> For locomotives originally manufactured before January 1, 2000, and not equipped with mw-hr meters.



*These standards apply to auxiliary and propulsion engines used by all types of recreational and commercial vessels, from small fishing boats to ocean-going ships.*

**Table 12.22**  
**Marine Compression-Ignition (CI) Engines – Exhaust Emission Standards**

|                      | Category <sup>a, b</sup>   | Tier                               | Displacement<br>(L/cylinder)  | Power <sup>c</sup><br>(kW) | Speed<br>(rpm) | Model<br>Year              | NOx (g/kW-<br>hr)          | HC (g/kW-<br>hr) | HC+NOx <sup>d</sup><br>(g/kW-hr) | PM (g/kW-<br>hr)        | CO (g/kW-<br>hr)   | Useful Life <sup>e</sup><br>(years/hours)   |                    |   |  |
|----------------------|--|------------------------------------|---|----------------------------|----------------|----------------------------|----------------------------|------------------|----------------------------------|-------------------------|--------------------|---|--------------------|---|--|
| Federal <sup>g</sup> | C1<br>Commercial   | 1                                  | 2.5   | 37                         | rpm < 130      | 2004 <sup>h</sup>          | 17.0                       | -                | -                                | -                       | -                  | 10 / 10,000                                 |                    |   |  |
|                      |  |                                    |   |                            | 130 rpm < 2000 |                            | 45.0 x N <sup>0.20 i</sup> | -                | -                                | -                       | -                  |   |                    |   |  |
|                      |  |                                    |   |                            | rpm 2000       |                            | 9.8                        | -                | -                                | -                       | -                  |   |                    |   |  |
|                      |  | 2                                  | disp. < 0.9   | 37                         | -              | 2005 <sup>h</sup>          | -                          | -                | 7.5 (ABT)                        | 0.40 (ABT)              | 5.0                | 10 / 10,000                                 |                    |   |  |
|                      |  |                                    | 0.9 disp < 1.2  | all                        | -              | 2004 <sup>h</sup>          | -                          | -                | 7.2 (ABT)                        | 0.30 (ABT)              | 5.0                |   |                    |   |  |
|                      |  |                                    | 1.2 disp < 2.5  |                            | -              | 2004 <sup>h</sup>          | -                          | -                | 7.2 (ABT)                        | 0.20 (ABT)              | 5.0                |   |                    |   |  |
|                      |  |                                    | 2.5 disp < 5.0  |                            | -              | 2007 <sup>h</sup>          | -                          | -                | 7.2 (ABT)                        | 0.20 (ABT)              | 5.0                |   |                    |   |  |
|                      |  | C1<br>Commercial &<br>Recreational | 1   | 2.5                        | 37             | rpm < 130                  | 2004                       | 17.0             | -                                | -                       | -                  | -   | 10/ 1,000          |   |  |
|                      | 130 rpm < 2000   |                                    |   |                            |                | 45.0 x N <sup>0.20 i</sup> |                            | -                | -                                | -                       | -                  |   |                    |   |  |
|                      | rpm 2000   |                                    |   |                            |                | 9.8                        |                            | -                | -                                | -                       | -                  |   |                    |   |  |
|                      | 2  |                                    | disp < 0.9  | 37                         | -              | 2007                       | -                          | -                | 7.5 (ABT)                        | 0.40 (ABT)              | 5.0                | 10 / 1,000                                  |                    |   |  |
|                      |  |                                    | 0.9 disp < 1.2  | all                        | -              | 2006                       | -                          | -                | 7.2 (ABT)                        | 0.30 (ABT)              | 5.0                |   |                    |   |  |
|                      |  |                                    | 1.2 disp < 2.5  |                            | -              | 2006                       | -                          | -                | 7.2 (ABT)                        | 0.20 (ABT)              | 5.0                |   |                    |   |  |
|                      |  |                                    | 2.5 disp < 5.0  |                            | -              | 2009                       | -                          | -                | 7.2 (ABT)                        | 0.20 (ABT)              | 5.0                |   |                    |   |  |
|                      | C1<br>Commercial &<br>Recreational<br>< 75 kW                                |                                    | 3   | < 0.9                      | < 8            | -                          | 2009+                      | -                | -                                | 7.5 (ABT)               | 0.40 (ABT)         | 8.0   | 5 / 3,000          | 10 / 1,000 for<br>CI<br>Recreational        |  |
|                      |  | 8 kW < 19                          |   |                            | -              | 2009+                      | -                          | -                | 7.5 (ABT)                        | 0.40 (ABT)              | 6.6                |   |                    |   |  |
|                      |  | 19 kW < 37                         |   |                            | -              | 2009-2013                  | -                          | -                | 7.5 <sup>j</sup> (ABT)           | 0.30 <sup>j</sup> (ABT) | 5.5                |   |                    |   |  |
|                      |  | -                                  |   |                            | -              | 2014+                      | -                          | -                | 4.7 <sup>j</sup> (ABT)           | 0.20 (ABT)              | 5.0                |   |                    |   |  |
|                      |  | 37 kW < 75                         |   |                            | -              | 2009-2013                  | -                          | -                | 7.5 <sup>j</sup> (ABT)           | 0.30 <sup>j</sup> (ABT) | 5.0                | 10 / 10,000                                 |                    |   |  |
|                      |  | -                                  |   |                            | -              | 2014+                      | -                          | -                | 4.7 <sup>j</sup> (ABT)           | 0.30 <sup>j</sup> (ABT) | 5.0                |   |                    |   |  |
|                      |  |                                    |   |                            |                |                            |                            |                  |                                  |                         |                    |   |                    |   |  |
|                      |  |                                    |   |                            |                |                            |                            |                  |                                  |                         |                    |   |                    |   |  |
|                      | C1<br>Commercial<br>Engines with<br>35 kW/L<br>power<br>density <sup>k</sup> | 3 <sup>i</sup>                     | < 0.9   | -                          | -              | 2012+                      | -                          | -                | 5.4 (ABT)                        | 0.14 (ABT)              | 8.0 for < 8 kW     | 5 / 3,000 for commercial<br>engines < 19 kW |                    |   |  |
|                      |  |                                    | 0.9 disp < 1.2  | All                        | -              | 2013+                      | -                          | -                | 5.4 (ABT)                        | 0.12 (ABT)              | 6.6 for 8 kW < 19  |   |                    |   |  |
|                      |  |                                    | 1.2 disp < 2.5  | < 600                      | -              | 2014-2017                  | -                          | -                | 5.6 (ABT)                        | 0.11 (ABT)              | 5.5 for 19 kW < 37 | 10 / 10,000 for C1<br>Commercial 37 kW      |                    |   |  |
|                      |  |                                    |   |                            | -              | 2018+                      | -                          |                  | 0.10 (ABT)                       | 5.0 for 37 kW           |                    |   |                    |   |  |
|                      |  |                                    | 2.5 disp < 3.5  | < 600                      | -              | 2014+                      | -                          | -                | 5.6 (ABT)                        | 0.11 (ABT)              |                    |   |                    |   |  |
|                      |  |                                    |   |                            | -              | 2013-2017                  | -                          |                  | 0.11 (ABT)                       |                         |                    |   |                    |   |  |
|                      |  |                                    | 2.5 disp < 3.5  | 600                        | -              | 2018+                      | -                          | -                | 5.6 (ABT)                        | 0.10 (ABT)              |                    |   |                    |   |  |
|                      |  |                                    |   |                            | -              | 2013+                      | -                          |                  | -                                | 5.6 (ABT)               | 0.11 (ABT)         |   |                    |   |  |
|                      |  |                                    | 3.5 disp < 7.0  | < 600                      | -              | 2012-2017                  | -                          | -                | 5.8 (ABT)                        | 0.11 (ABT)              |                    |   |                    |   |  |
|                      |  |                                    |   |                            | -              | 2018+                      | -                          |                  | 0.10 (ABT)                       |                         |                    |   |                    |   |  |
|                      |  |                                    | 3.5 disp < 7.0  | 600                        | -              | 2012+                      | -                          | -                | 5.8 (ABT)                        | 0.11 (ABT)              |                    |   |                    |   |  |
|                      |  |                                    |   |                            |                |                            |                            |                  |                                  |                         |                    |   |                    |   |  |
|                      |  |                                    | C1<br>Commercial<br>engines with<br>> 35 kW/L<br>power<br>density & All<br>Recreational<br>Engines <sup>k</sup> | 3 <sup>i</sup>             | < 0.9          | 75                         | -                          | 2012+            | -                                | -                       | 5.8 (ABT)          | 0.15 (ABT)                                  | 8.0 for < 8 kW     | 5 / 3,000 for commercial<br>engines < 19 kW |  |
|                      |  |                                    |   |                            | 0.9 disp < 1.2 | All                        | -                          | 2013+            | -                                | -                       | 5.8 (ABT)          | 0.14 (ABT)                                  | 6.6 for 8 kW < 19  |   |  |
|                      |  |                                    |   |                            | 1.2 disp < 2.5 |                            | -                          | 2014+            | -                                | -                       | 5.8 (ABT)          | 0.14 (ABT)                                  | 5.5 for 19 kW < 37 | 10 / 10,000 for C1<br>Commercial 37 kW      |  |
|                      | 2.5 disp < 3.5   | -                                  |   |                            | 2013+          |                            | -                          | -                | 5.8 (ABT)                        | 0.12 (ABT)              | 5.0 for 37 kW      |   |                    |   |  |
|                      | 3.5 disp < 7.0   | -                                  |   |                            | 2012+          |                            | -                          | -                | 5.8 (ABT)                        | 0.11 (ABT)              |                    | 10 / 1,000 for CI<br>Recreational           |                    |   |  |
|                      |  |                                    |   |                            |                |                            |                            |                  |                                  |                         |                    |   |                    |   |  |

(Continued on next page)



**Table 12.22 (continued)**  
**Marine Compression-Ignition (CI) Engines – Exhaust Emission Standards**

|                      | Category <sup>a,b</sup>      | Tier                | Displacement<br>(L/cylinder) | Power <sup>c</sup><br>(kW)       | Speed<br>(rpm)     | Model<br>Year              | NOx (g/kW-<br>hr)          | HC (g/kW-<br>hr) | HC+NOx <sup>d</sup><br>(g/kW-hr) | PM (g/kW-<br>hr) | CO (g/kW-<br>hr) | Useful Life <sup>e</sup><br>(years/hours) |
|----------------------|------------------------------|---------------------|------------------------------|----------------------------------|--------------------|----------------------------|----------------------------|------------------|----------------------------------|------------------|------------------|---|
| Federal <sup>g</sup> | C1<br>Commercial ><br>600 kW | 4 <sup>m</sup>      | All                          | 600 kW <<br>1,400                | -                  | 2017+                      | 1.8 (ABT)                  | -                | 0.19 HC <sup>n</sup>             | 0.04 (ABT)       | 5.0              | 10 / 10,000                               |
|                      |                              |                     | All                          | 1,400 kW <<br>2,000              | -                  | 2016+                      | 1.8 (ABT)                  | -                | 0.19 HC <sup>n</sup>             | 0.04 (ABT)       |                  |   |
|                      |                              |                     | All                          | 2,000 kW <<br>3,700              | -                  | 2014+                      | 1.8 (ABT)                  | -                | 0.19 HC <sup>n</sup>             | 0.04 (ABT)       |                  |   |
|                      |                              |                     | < 7.0                        | 3,700                            | -                  | 2014-2015                  | 1.8 (ABT)                  | -                | 0.19 HC <sup>n</sup>             | 0.12 (ABT)       |                  |   |
|                      |                              |                     |                              |                                  | -                  | 2016+                      | 1.8 (ABT)                  | -                | 0.19 HC <sup>n</sup>             | 0.06 (ABT)       |                  |   |
|                      | C2                           | 1                   | 2.5                          | 37                               | rpm < 130          | 2004                       | 17.0                       | -                | -                                | -                | -                | 10 / 20,000                               |
|                      |                              |                     |                              |                                  | 130 rpm <<br>2,000 |                            | 45.0 x N <sup>0.20 i</sup> | -                | -                                | -                | -                |   |
|                      |                              |                     |                              |                                  | rpm 2,000          |                            | 9.8                        | -                | -                                | -                | -                |   |
|                      |                              | 2                   | 5.0 disp <<br>15.0           | all                              | -                  | 2007                       | -                          | -                | 7.8 (ABT)                        | 0.27 (ABT)       | 5.0              | 10 / 20,000                               |
|                      |                              |                     | 15.0 disp <<br>20.0          | < 3,300                          | -                  |                            | -                          | -                | 8.7 (ABT)                        | 0.50 (ABT)       | 5.0              |   |
|                      |                              |                     | 15.0 disp <<br>20.0          | 3,300                            | -                  |                            | -                          | -                | 9.8 (ABT)                        | 0.50 (ABT)       | 5.0              |   |
|                      |                              |                     | 20.0 disp <<br>25.0          | all                              | -                  |                            | -                          | -                | 9.8 (ABT)                        | 0.50 (ABT)       | 5.0              |   |
|                      |                              |                     | 25.0 disp <<br>30.0          | all                              | -                  |                            | -                          | -                | 11.0 (ABT)                       | 0.50 (ABT)       | 5.0              |   |
|                      |                              | 3 <sup>m,p</sup>    | 7.0 disp <<br>15.0           | < 2,000                          | -                  | 2013+                      | -                          | -                | 6.2 (ABT)                        | 0.14 (ABT)       | 5.0              | 10 / 20,000                               |
|                      |                              |                     |                              | 2,000 kW <<br>3,700              | -                  |                            | -                          | -                | 7.8 (ABT)                        | 0.14 (ABT)       | 5.0              |   |
|                      |                              |                     | 15.0 disp <<br>20.0          | < 2,000                          | -                  | 2014+                      | -                          | -                | 7.0 (ABT)                        | 0.34 (ABT)       | 5.0              |   |
|                      |                              |                     | 20.0 disp <<br>25.0          | < 2,000                          | -                  |                            | -                          | -                | 9.8 (ABT)                        | 0.27 (ABT)       | 5.0              |   |
|                      |                              | 25.0 disp <<br>30.0 | < 2,000                      | -                                |                    | -                          | -                          | 11.0 (ABT)       | 0.27 (ABT)                       | 5.0              |                  |   |
|                      |                              | 4 <sup>m,p</sup>    | All                          | 600 kW <<br>1,400                | -                  | 2017+                      | 1.8 (ABT)                  | -                | 0.19 HC <sup>n</sup>             | 0.04 (ABT)       | 5.0              | 10 / 20,000                               |
|                      |                              |                     | All                          | 1400 kW <<br>2,000               | -                  | 2016+                      | 1.8 (ABT)                  | -                | 0.19 HC <sup>n</sup>             | 0.04 (ABT)       |                  |   |
|                      |                              |                     | All                          | 2,000 kW <<br>3,700 <sup>q</sup> | -                  | 2014+                      | 1.8 (ABT)                  | -                | 0.19 HC <sup>n</sup>             | 0.04 (ABT)       |                  |   |
|                      |                              |                     | < 15.0                       | 3,700                            | -                  | 2014-2015                  | 1.8 (ABT)                  | -                | 0.19 HC <sup>n</sup>             | 0.12 (ABT)       |                  |   |
|                      |                              |                     | 15.0 disp <<br>30.0          |                                  | -                  | 2014-2015                  | 1.8 (ABT)                  | -                | 0.19 HC <sup>n</sup>             | 0.25 (ABT)       |                  |   |
|                      |                              |                     | All                          |                                  | -                  | 2016+                      | 1.8 (ABT)                  | -                | 0.19 HC <sup>n</sup>             | 0.06 (ABT)       |                  |   |
|                      | C3                           | 1                   | 30.0                         | All                              | rpm < 130          | 2004                       | 17.0                       | -                | -                                | -                | -                | 3 / 10,000                                |
|                      |                              |                     |                              |                                  | 130 rpm <<br>2,000 |                            | 45.0 x N <sup>0.20 i</sup> | -                | -                                | -                | -                |   |
|                      |                              |                     |                              |                                  | rpm 2,000          |                            | 9.8                        | -                | -                                | -                | -                |   |
| 2                    |                              | 30.0                | All                          | rpm < 130                        | 2011               | 14.4                       | 2.0                        | -                | -                                | 5.0              | 3 / 10,000       |   |
|                      |                              |                     |                              | 130 rpm <<br>2,000               |                    | 44.0 x N <sup>0.23 i</sup> |                            | -                | -                                |                  |                  |   |
|                      |                              |                     |                              | rpm 2,000                        |                    | 7.7                        |                            | -                | -                                |                  |                  |   |
| 3                    |                              | 30.0                | All                          | rpm < 130                        | 2016               | 3.4                        | 2.0                        | -                | -                                | 5.0              | 3 / 10,000       |   |
|                      |                              |                     |                              | 130 rpm <<br>2,000               |                    | 9.0 x N <sup>0.20 i</sup>  |                            | -                | -                                |                  |                  |   |
|                      |                              |                     |                              | rpm 2,000                        |                    | 2.0                        |                            | -                | -                                |                  |                  |   |

**Sources:**

40 CFR 89.104 = Tiers 1 and 2 useful life & warranty period for marine CI engines less than 37 kW

40 CFR 89.112 = Tiers 1 and 2 emission standards for marine CI engines less than 37 kW

40 CFR 89 Subpart E = Tiers 1 and 2 test procedures for marine CI engines less than 37 kW

40 CFR 94.8 = Tiers 1 and 2 emission standards for C1 (both commercial & recreational), C2 and C3 engines

40 CFR 94.9 = Tiers 1 and 2 useful life for C1 (both commercial & recreational), C2 and C3 engines

40 CFR 94 Subpart B = Tiers 1 and 2 test procedures for C1 (both commercial & recreational), C2 and C3 engines

40 CFR 1042.101 = Tiers 3 and 4 exhaust emission standards and useful life



**Table 12.22 (continued)**  
**Marine Compression-Ignition (CI) Engines – Exhaust Emission Standards**

**Sources (continued):**

40 CFR 1042.107 = Tiers 3 and 4 evaporative emission standards engines using a volatile liquid fuel (e.g., methanol)

40 CFR 1042.120 = Tiers 3 and 4 warranty period

40 CFR 1042 Subpart F = Tiers 3 and 4 test procedures (Additional resources: [www.epa.gov/otaq/standards](http://www.epa.gov/otaq/standards))

<sup>a</sup> For Tiers 1 and 2, Category 1 marine engines are greater than or equal to 37 kilowatts (kW) and have a displacement less than 5.0 liters per cylinder (L/cylinder); Category 2 marine engines have a displacement greater than or equal to 5.0 L/cylinder and less than 30 L/cylinder; and Category 3 marine engines have a displacement greater than or equal to 30.0 L/cylinder. For Tiers 3 and 4, Category 1 represents engines up to 7 L/cylinder displacement; and Category 2 includes engines from 7 to 30 L/cylinder. The definition of Category 3 marine engines remains the same.

<sup>b</sup> Tiers 1 and 2 for marine engines less than 37 kW are subject to the same emission standards as for land-based engines. See Table 1 in 40 Code of Federal Regulations (CFR) Part 89.112 and 40 CFR Part 89.104.

<sup>c</sup> For Tiers 1 and 2, this refers to the rated power; for Tiers 3 and 4, this refers to the maximum engine power.

<sup>d</sup> Total hydrocarbon (THC) plus nitrogen oxides (NOx) for Tier 2 standards.

<sup>e</sup> Useful life is expressed in hours or years, whichever comes first. For Tiers 3 and 4, a longer useful life in hours for an engine family must be specified if either: 1) the engine is designed, advertised, or marketed to operate longer than the minimum useful life; or 2) the basic mechanical warranty is longer than the minimum useful life.

<sup>f</sup> Warranty period is expressed in years and hours, whichever comes first.

<sup>g</sup> For Tiers 3 and 4, there are no evaporative emission standards for diesel-fueled engines, or engines using other nonvolatile or nonliquid fuels (e.g., natural gas). If an engine uses a volatile liquid fuel, such as methanol, the engine's fuel system and the vessel in which the engine is installed must meet the evaporative emission requirements of 40 Code of Federal Regulations (CFR) Part 1045 that apply with respect to spark-ignition engines. Manufacturers subject to evaporative emission standards must meet the requirements of 40 CFR 1045.112 as described in 40 CFR 1060.1(a)(2).

<sup>h</sup> Indicates the model years for which the specified standards start.

<sup>i</sup> N is the maximum test speed of the engine in revolutions per minute (rpm).

<sup>j</sup> Manufacturers of Tier 3 engines greater than or equal to 19 kW and less than 75 kW with displacement below 0.9 L/cylinder may alternatively certify some or all of their engine families to a particulate matter (PM) emission standard of 0.20 grams per kilowatt-hour (g/kW-hr) and a NOx+HC emission standard of 5.8 g/kW-hr for 2014 and later model years.

<sup>k</sup> The applicable Tier 2 NOx+HC standards continue to apply instead of the Tier 3 values for engines at or above 2000 kW.

<sup>l</sup> These Tier 3 standards apply to Category 1 engines below 3700 kW except for recreational marine engines at or above 3700 kW (with any displacement), which must meet the Tier 3 standards specified for recreational marine engines with a displacement of 3.5 to 7.0 L/cylinder.

<sup>m</sup> The following provisions are optional: 1) Manufacturers may use NOx credits to certify Tier 4 engines to a NOx+HC emission standard of 1.9 g/kW-hr instead of the NOx and HC standards. See 40 CFR 1042.101(a)(8)(i) for more details. 2) For engines below 1000 kW, manufacturers may delay complying with the Tier 4 standards until October 1, 2017. 3) For engines at or above 3700 kW, manufacturers may delay complying with the Tier 4 standards until December 31, 2016.

<sup>n</sup> The Tier 4 standard is for HC (not HC+NOx) in g/kW-hr.

<sup>o</sup> These Tier 3 standards apply to Category 2 engines below 3700 kW; no Tier 3 standards apply for Category 2 engines at or above 3700 kW, although there are Tier 4 standards that apply.



**Table 12.22 (continued)**  
**Marine Compression-Ignition (CI) Engines – Exhaust Emission Standards**

<sup>p</sup> An alternative set of Tier 3 and Tier 4 standards for PM, NO<sub>x</sub>, and HC are available for Category 2 engines at or above 1400 kW, but must be applied to all of a manufacturer's engines in a given displacement category in model years 2012 through 2015.

| Tier | Maximum<br>Engine<br>Power |        | Model<br>Year | PM<br>(g/kW-hr) | NO <sub>x</sub><br>(g/kW-hr) | HC<br>(g/kW-hr) |
|------|----------------------------|--------|---------------|-----------------|------------------------------|-----------------|
| 3    | kW                         | 1400   | 2012-2014     | 0.14            | 7.8 NO <sub>x</sub> +HC      |                 |
| 4    | 1400 kW                    | < 3700 | 2015          | 0.04            | 1.8                          | 0.19            |
|      | kW                         | 3700   | 2015          | 0.06            | 1.8                          | 0.19            |

<sup>q</sup> Interim Tier 4 PM standards apply for 2014 and 2015 model year Category 2 engines with per-cylinder displacement at or above 15.0 liters: 0.34 g/kW-hr for engines 2000 = kW < 3000, and 0.27 g/kW-hr for engines 3300 = kW < 3700.



*These standards apply to gasoline boats and personal watercraft, such as pleasure boats, jet-skis, outboard engines and sterndrive/inboard engines.*

**Table 12.23**  
**Marine Spark-Ignition Engines and Vessels – Exhaust Emission Standards**

|                      | Engine Type                                   | Model Year                        | HC + NO <sub>x</sub> <sup>a</sup><br>(g/KW-hr) |  | CO <sup>c</sup><br>(g/KW-hr) |                         | Useful Life<br>(hours/years) <sup>d</sup>                                    |
|----------------------|---|-----------------------------------|--|--|------------------------------|-------------------------|--|
|                      |   |                                   | P 4.3 kW <sup>b</sup>                          | P > 4.3 kW <sup>b</sup>                              | P 4.3 kW <sup>b</sup>        | P > 4.3 kW <sup>b</sup> |  |
| Federal <sup>e</sup> | Personal Watercraft & Outboard Marine Engines | 1998                              | 278 ABT  | $(0.917 \times (151 + 557/P^{0.9}) + 2.44)$<br>[ABT] | --                           | --                      | 350 / 5  |
|                      |   | 1999                              | 253 ABT  | $(0.833 \times (151 + 557/P^{0.9}) + 2.89)$<br>[ABT] | --                           | --                      |  |
|                      |   | 2000                              | 228 ABT  | $(0.750 \times (151 + 557/P^{0.9}) + 3.33)$<br>[ABT] | --                           | --                      |  |
|                      |   | 2001                              | 204 ABT  | $(0.667 \times (151 + 557/P^{0.9}) + 3.78)$<br>[ABT] | --                           | --                      |  |
|                      |   | 2002                              | 179 ABT  | $(0.583 \times (151 + 557/P^{0.9}) + 4.22)$<br>[ABT] | --                           | --                      |  |
|                      |   | 2003                              | 155 ABT  | $(0.500 \times (151 + 557/P^{0.9}) + 4.67)$<br>[ABT] | --                           | --                      |  |
|                      |   | 2004                              | 130 ABT  | $(0.417 \times (151 + 557/P^{0.9}) + 5.11)$<br>[ABT] | --                           | --                      |  |
|                      |   | 2005                              | 105 ABT  | $(0.333 \times (151 + 557/P^{0.9}) + 5.56)$<br>[ABT] | --                           | --                      |  |
|                      |   | 2006-2009                         | 81 ABT   | $(0.250 \times (151 + 557/P^{0.9}) + 6.00)$<br>[ABT] | --                           | --                      |  |
|                      |   | 2010 + <sup>g</sup>               | 30 ABT<br>[ABT]                                | $2.1 + 0.09 \times (151 + 557/P^{0.9})$<br>[ABT]     | 500 - 5.0<br>x P             | 300                     | Personal Watercraft: 350 / 5 <sup>h</sup><br>Outboard: 350 / 10 <sup>h</sup> |
|                      | Sterndrive/Inboard Engines                    | Conventional Engines <sup>g</sup> | 2010 +   | 5.0<br>[ABT]   | 75<br>[ABT]                  |                         | 480 / 10 <sup>i</sup>  |
|                      |   | High-Performance Engines          | P kW <sup>b</sup>                              | P > 485 kW <sup>b</sup>                              | 350                          |                         | P 485 kW:<br>150 / 3   |
|                      |   |                                   | 2010   | 20.0   |                              |                         | P > 485 kW:<br>50 / 1  |
|                      |   |                                   | 2011+  | 16.0   |                              |                         | 22.0   |

**Sources:**

40 CFR 91.104 = Outboard and personal watercraft (PWC) exhaust emission standards (1998-2009)

40 CFR 91.105 = Outboard and PWC useful life (1998-2009)

40 CFR 1045.103 = Outboard and PWC exhaust emission standards (2010+)

40 CFR 1045.105 = Sterndrive/Inboard exhaust emission standards

40 CFR 1045.107 = Not-to-exceed exhaust emission standards (Additional resources: [www.epa.gov/otaq/standards](http://www.epa.gov/otaq/standards))

<sup>a</sup> The numerical emission standards for hydrocarbons (HC) must be met based on the following types of HC emissions for engines powered by the following fuels: (1) total hydrocarbon equivalent for alcohol; (2) non-methane hydrocarbon for natural gas; and (3) total hydrocarbons for other fuels.



**Table 12.23 (continued)**  
**Marine Spark-Ignition Engines and Vessels – Exhaust Emission Standards**

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<sup>b</sup> P stands for the maximum engine power in kilowatts.

<sup>c</sup> Manufacturers may generate or use emission credits for averaging, but not for banking or trading.

<sup>d</sup> Useful life and warranty period are expressed hours or years of operation (unless otherwise indicated), whichever comes first.

<sup>e</sup> The test procedure for federal standards uses the International Organization for Standardization (ISO) 8178 E4 5-Mode Steady-State Test Cycle.

<sup>f</sup> Also applies to model year (MY) 1997 engine families certified pursuant to 40 Code of Federal Regulations (CFR) 91.205.

<sup>g</sup> Not-to-exceed emission standards specified in 40 CFR 1045.107 also apply.

<sup>h</sup> A longer useful life in terms of hours must be specified for the engine family if the average service life is longer than the minimum value as described in 40 CFR 1045.103(e)(3).

<sup>i</sup> The useful life may not be shorter than: (1) 150 hours of operation; (2) the recommended overhaul interval; or (3) the engine's mechanical warranty. A longer useful life must be specified in terms of hours if the average service life is longer than the minimum value as described in 40 CFR 1045.105(e)(3).



*These standards apply to land-based recreational vehicles, such as snowmobiles, dirt bikes, all-terrain vehicles and go-karts.*

**Table 12.24**  
**Nonroad Recreational Engines and Vehicles – Exhaust Emission Standards**

|         | Vehicle                                 | Phase          | Year          | HC <sup>a</sup><br>g/kW-hr | HC +<br>NO <sub>x</sub><br>g/km | CO                        |                            | Minimum Useful<br>Life<br>(hours/years/km) <sup>b</sup>                                      |
|---------|---|----------------|---------------|----------------------------|---------------------------------|---------------------------|----------------------------|--|
|         |   |                |               |                            |                                 | g/kW-hr                   | g/km                       |  |
| Federal | Snowmobiles <sup>c</sup>                | 1 <sup>d</sup> | 2006+         | 100<br>[ABT]               | -                               | 275<br>[ABT]              | -                          | 400 / 5 / 8,000  |
|         |   | 2              | 2010-<br>2011 | 75 [ABT]                   | -                               | 275<br>[ABT]              | -                          |  |
|         |   | 3 <sup>e</sup> | 2012+         | 150 <sup>f</sup><br>[ABT]  | -                               | 400 <sup>f</sup><br>[ABT] | -                          |  |
|         | Off-highway<br>motorcycles <sup>g</sup> | 1 <sup>d</sup> | 2006+         | -                          | 2.0 <sup>h,i</sup><br>[ABT]     | -                         | 25 <sup>h,i</sup><br>[ABT] | > 70 cc<br>Displacement: - / 5 /<br>10,000<br>70 cc<br>Displacement: - / 5 /<br>5,000        |
|         | ATVs <sup>g</sup>                       | 1 <sup>d</sup> | 2006+         | -                          | 1.5 <sup>i,k</sup><br>[ABT]     | -                         | 35 <sup>k</sup><br>[ABT]   | 100 cc<br>Displacement: 1000 /<br>5 / 10,000<br>< 100 cc<br>Displacement: 500 /<br>5 / 5,000 |
|         |   |                |               |                            |                                 |                           |                            |  |

**Sources:**

40 CFR 1051.101-115 = Emission standards (Additional resources: [www.epa.gov/otaq/standards](http://www.epa.gov/otaq/standards))

<sup>a</sup> The numerical emission standards for hydrocarbons (HC) must be met based on the following types of hydrocarbon emissions for recreational engines and vehicles powered by the following fuels: (1) non-methane hydrocarbons for natural gas; (2) total hydrocarbon equivalent for alcohol; and (3) total hydrocarbons for other fuels.

<sup>b</sup> Useful life is expressed in hours, years, or kilometers, whichever comes first; warranty period is expressed in hours, months, or kilometers (km), whichever comes first. Nonroad recreational engines and vehicles must meet emission standards over their full useful life. A longer useful life in terms of km and hours must be specified for the engine family if the average service life is longer than the minimum value as described in 40 Code of Federal Regulations (CFR) 1051 Subpart B.

<sup>c</sup> Test procedures for snowmobiles use the equipment and procedures for spark-ignition engines in 40 CFR Part 1065.

<sup>d</sup> Phase 1 standards will be phased in: 50 percent by 2006, 100 percent by 2007.

<sup>e</sup> Litigation on the November 2002 final rule resulted in a court decision that requires EPA to clarify the evidence and analysis upon which the Phase 3 carbon monoxide (CO) and HC standards were based. EPA will address this in a future rulemaking.

<sup>f</sup> These are the maximum allowable family emission limits (FEL). The HC and CO standards are defined by a functional relationship as described in 40 CFR 1051.103(a)(2).

<sup>g</sup> For off-highway motorcycles and ATVs, chassis dynamometer emissions test procedures are specified in 40 CFR Part 86, Subpart F and engine dynamometer emissions test procedures are specified in 40 CFR Part 1065.

<sup>h</sup> Maximum allowable FEL: 20.0 grams per kilometer (g/km) for HC plus nitrogen oxides (NO<sub>x</sub>) and 50 g/km for CO.





**Table 12.24 (continued)**  
**Nonroad Recreational Engines and Vehicles – Exhaust Emission Standards**

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<sup>i</sup> Manufacturers may certify off-highway motorcycles with engines that have total displacement of 70 cubic centimeters (cc) or less to an HC+NO<sub>x</sub> standard of 16.1 grams per kilowatt-hour (g/kW-hr) (with an FEL cap of 32.2 g/kW-hr) and a CO standard of 519 g/kW-hr.

<sup>j</sup> Maximum allowable FEL for HC+NO<sub>x</sub> is 20.0 g/km.

<sup>k</sup> Manufacturers may certify all-terrain vehicles with engines that have total displacement of less than 100 cc to an HC+NO<sub>x</sub> standard of 25.0 g/KW-hr (with an FEL cap of 40.0 g/kW-hr) and a CO standard of 500 g/kW-hr.



*These standards were established in conjunction with the Tier 2 light vehicle standards to maintain the performance of catalytic converters.*

**Table 12.25**  
**Gasoline Sulfur Standards**

|         | Regulated Entity                        | Refinery Average and<br>Per-gallon Cap by Year (ppm) |                            |           |         |         |         |         |         |
|---------|---|--|----------------------------|-----------|---------|---------|---------|---------|---------|
|         |   | 2004   | 2005                       | 2006      | 2007    | 2008    | 2009    | 2010    | 2010    |
| Federal | Large Refiners / Importers <sup>a</sup> | 120 <sup>b</sup> / 300 <sup>c</sup>                  | 30 / 90 <sup>b</sup> / 300 | 30 / 80   | 30 / 80 | 30 / 80 | 30 / 80 | 30 / 80 | 30 / 80 |
|         | GPA Refiners <sup>d, e</sup>            | 150 / 300 <sup>c</sup>                               | 150 / 300                  | 150 / 300 | 30 / 80 | 30 / 80 | 30 / 80 | 30 / 80 | 30 / 80 |
|         | Small Refiners <sup>f, g, h</sup>       | k  | k                          | k         | k       | 30 / 80 | 30 / 80 | 30 / 80 | 30 / 80 |
|         | Downstream Standards <sup>i, j</sup>    | 378  | 326                        | 95        | 95      | 95      | 95      | 95      | 95      |

**Source:**

40 CFR Part 80 Subpart H (Additional resources: [www.epa.gov/otaq/standards](http://www.epa.gov/otaq/standards))

<sup>a</sup> Standards effective January 1 at the refinery gate.

<sup>b</sup> No Refinery Average Standard applies in 2004; Corporate Average Standard applies in 2004 (120 ppm) and 2005 (90 ppm).

<sup>c</sup> Cap exceedances up to 50 ppm in 2004 must be made up in 2005.

<sup>d</sup> Geographic Phase-in Area (GPA) refiners must also comply with the corporate average standards in 2004 and 2005 if less than 50% of the refiner's gasoline is designated as GPA gasoline in a given compliance period.

<sup>e</sup> GPA refiners may receive an additional two years (i.e., through 2008) to comply with the 30 / 80 ppm gasoline sulfur standards in exchange for producing 95% of their highway diesel fuel at the 15 ppm sulfur standard by June 1, 2006.

<sup>f</sup> Small refiners may receive an additional two years (i.e., through 2009) to comply with the 30 / 80 ppm gasoline sulfur standards via a hardship demonstration.

<sup>g</sup> Small refiners may receive an additional three years (i.e., through 2010) to comply with the 30 / 80 ppm gasoline sulfur standards in exchange for producing 95% of their highway diesel fuel at the 15 ppm sulfur standard by June 1, 2006.

<sup>h</sup> Small refiners may receive a 20% increase in their annual average and per-gallon cap standards in exchange for producing 95% of their highway, nonroad, locomotive, and marine diesel fuel at the 15 ppm sulfur standard by June 1, 2006.

<sup>i</sup> Downstream standards are effective February 1 at any downstream location other than at a retail outlet or wholesale purchaser-consumer (e.g., pipelines and terminals) and March 1 at any downstream location.

<sup>j</sup> Downstream standards for gasoline that is not blended with small refiner gasoline are shown. Refer to the Code of Federal Regulations (CFR) for the downstream standards that apply when a gasoline blend includes small refiner gasoline.

<sup>k</sup>

| 1997-98 Refinery<br>Baseline Sulfur Level<br>(ppm) | Small Refiner Interim Gasoline Sulfur<br>Standards (ppm) 2004 - 2007 |                     |
|--|--|---------------------|
|  | Average  | Cap                 |
| 0 to 30  | 30   | 300                 |
| 31 to 200  | baseline level   | 300                 |
| 201 to 400   | 200  | 300                 |
| 401 to 600   | 50% of baseline  | 1.5 x avg. standard |
| 601 and above                                      | 300  | 450                 |



*Ultra-low sulfur diesel (ULSD) fuel is necessary for new advanced emission control technologies. It also reduces particulate matter in the existing fleet of nonroad engines and equipment.*

**Table 12.26**  
**Highway, Nonroad, Locomotive, and Marine (NRLM) Diesel Fuel Sulfur Standards**

|         | Regulated Entity            | Covered Fuel                   | Per-gallon Maximum Sulfur Level by Year (ppm) |                   |      |      |                     |      |      |      |      |
|---------|-----------------------------|--------------------------------|---|-------------------|------|------|---------------------|------|------|------|------|
|         |                             |                                | 2006 <sup>a</sup>                             | 2007 <sup>b</sup> | 2008 | 2009 | 2010 <sup>c,d</sup> | 2011 | 2012 | 2013 | 2014 |
| Federal | Large Refiners & Importers  | Highway                        | 80% 15<br>20% 500                             |                   |      |      | 15                  |      |      |      |      |
|         | Small Refiners              | Highway                        | 500   |                   |      |      |                     |      |      |      |      |
|         | Large Refiners & Importers  | NR                             | -   | 500               | 500  | 500  | 15                  | 15   | 15   | 15   | 15   |
|         |                             | LM                             | -   | 500               | 500  | 500  | 500                 | 500  | 15   | 15   | 15   |
|         |                             | NRLM with Credits <sup>e</sup> | -   | HS                | HS   | HS   | 500                 | 500  | 500  | 500  | 15   |
|         | Small Refiners              | NRLM <sup>f</sup>              | -   | HS                | HS   | HS   | 500                 | 500  | 500  | 500  | 15   |
|         | Transmix Processor & In-use | NR <sup>e</sup>                | -   | HS                | HS   | HS   | 500                 | 500  | 500  | 500  | 15   |
|         |                             | LM <sup>e</sup>                | -   | HS                | HS   | HS   | 500                 | 500  | 500  | 500  | 500  |

**Source:**

40 CFR Part 80 Subpart I (Additional resources: [www.epa.gov/otaq/standards](http://www.epa.gov/otaq/standards))

<sup>a</sup> For highway diesel fuel, standards are effective June 1 for refiners/importers, September 1 for pipelines and terminals, and October 15 for retailers and wholesale purchaser-consumers. Anti-downgrading provisions effective October 16, 2006.

<sup>b</sup> For Nonroad, Locomotive, and Marine (NRLM) diesel fuel, standards are effective June 1 for refiners; downstream requirements apply for Northeast/Mid-Atlantic area only (August 1 for terminals, October 1 for retailers and wholesale purchaser-consumers, and December 1 for in-use).

<sup>c</sup> For highway diesel fuel, standards are effective June 1 for refiners/importers, October 1 for pipelines and terminals, and December 1 for retailers and wholesale purchaser-consumers.

<sup>d</sup> For NRLM diesel fuel, standards are effective June 1 for refiners, August 1 for terminals, October 1 for retailers and wholesale purchaser-consumers, and December 1 for in-use.

<sup>e</sup> Excluding the Northeast and Alaska.

<sup>f</sup> Excluding the Northeast, with approval in Alaska.





**APPENDIX A**

**SOURCES & METHODOLOGIES**



## SOURCES & METHODOLOGIES

This appendix contains documentation of the estimation procedures used by ORNL. The reader can examine the methodology behind the estimates and form an opinion as to their utility. The appendix is arranged by subject heading. Only tables which contain ORNL estimations are documented in Appendix A; all other tables have sources listed at the bottom of the table. Since abbreviations are used throughout the appendix, a list of abbreviations is also included.

### Contents of Appendix A

|   |      |
|---|------|
| List of Abbreviations Used in Appendix A .....  | A-4  |
| Energy Use Sources .....                        | A-5  |
| Highway energy use .....                        | A-5  |
| Off-highway energy use .....                    | A-11 |
| Nonhighway energy use .....                     | A-11 |
| Passenger Travel and Energy Use .....           | A-21 |
| Highway Passenger Mode Energy Intensities ..... | A-25 |
| Nonhighway Mode Energy Intensities .....        | A-27 |
| Freight Movement and Energy Use .....           | A-28 |
| Freight Mode Energy Intensities .....           | A-29 |

## List of Abbreviations Used in Appendix A

|        |  |
|--------|--|
| AAMA   | American Automobile Manufacturers Association        |
| AAR    | Association of American Railroads                    |
| APTA   | American Public Transportation Association           |
| Amtrak | National Railroad Passenger Corporation              |
| Btu    | British thermal unit                                 |
| DOC    | Department of Commerce                               |
| DOE    | Department of Energy                                 |
| DOT    | Department of Transportation                         |
| EIA    | Energy Information Administration                    |
| EPA    | Environmental Protection Agency                      |
| FAA    | Federal Aviation Administration                      |
| FHWA   | Federal Highway Administration                       |
| GSA    | General Services Administration                      |
| gvw    | gross vehicle weight                                 |
| lpg    | liquefied petroleum gas                              |
| mpg    | miles per gallon                                     |
| NHTS   | National Household Travel Survey                     |
| NHTSA  | National Highway Traffic Safety Administration       |
| NPTS   | Nationwide Personal Transportation Survey            |
| NVPP   | National Vehicle Population Profile                  |
| ORNL   | Oak Ridge National Laboratory                        |
| pmt    | passenger-miles traveled                             |
| RECS   | Residential Energy Consumption Survey                |
| RTECS  | Residential Transportation Energy Consumption Survey |
| TIUS   | Truck Inventory and Use Survey                       |
| TSC    | Transportation Systems Center                        |
| VIUS   | Vehicle Inventory and Use Survey                     |
| vmt    | vehicle-miles traveled                               |



## Energy Use Sources

### Highway energy use

#### Automobiles

Fuel use in gallons (1970-2008) from: DOT, FHWA, *Highway Statistics 2008*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary* to 1995. Data for 2009 were estimated; FHWA discontinued automobile fuel use data in 2009. Fuel use was distributed among fuel types using the percentages shown in Table A.1. The FHWA discontinued gasohol data in 2005. Therefore, data from EIA, *Alternatives to Traditional Transportation Fuels*, 2006, Table C1 were used.

**Table A.1**  
**Automobile Fuel Use and Fuel Type Shares for Calculation of Energy Use**

| Year                                     | Fuel use<br>(million gallons) | Source for<br>Gasohol shares | Source for<br>gasoline/diesel shares | Shares by fuel type |            |            |
|--|-------------------------------|------------------------------|--------------------------------------|---------------------|------------|------------|
|  |                               |                              |                                      | Gasoline            | Gasohol    | Diesel     |
| 1970                                     | 67,820                        |                              | 1984 NVPP                            | 99.8%               | 0.0%       | 0.2%       |
| 1971                                     | 71,346                        |                              | interpolated                         | 99.2%               | 0.0%       | 0.8%       |
| 1972                                     | 75,937                        |                              | interpolated                         | 98.7%               | 0.0%       | 1.3%       |
| 1973                                     | 78,233                        |                              | interpolated                         | 98.1%               | 0.0%       | 1.9%       |
| 1974                                     | 74,229                        |                              | interpolated                         | 97.5%               | 0.0%       | 2.5%       |
| 1975                                     | 74,140                        |                              | interpolated                         | 97.0%               | 0.0%       | 3.0%       |
| 1976                                     | 78,297                        |                              | interpolated                         | 96.4%               | 0.0%       | 3.6%       |
| 1977                                     | 79,060                        |                              | interpolated                         | 95.8%               | 0.0%       | 4.2%       |
| 1978                                     | 80,652                        |                              | interpolated                         | 95.3%               | 0.0%       | 4.7%       |
| 1979                                     | 76,588                        |                              | 1979 RTECS                           | 94.7%               | 0.0%       | 5.3%       |
| 1980                                     | 69,981                        | FHWA, MF-33e                 | interpolated                         | 93.9%               | 0.5%       | 5.6%       |
| 1981                                     | 69,112                        | FHWA, MF-33e                 | 1981 RTECS                           | 93.4%               | 0.7%       | 5.9%       |
| 1982                                     | 69,116                        | FHWA, MF-33e                 | interpolated                         | 93.5%               | 2.3%       | 4.2%       |
| 1983                                     | 70,322                        | FHWA, MF-33e                 | 1983 RTECS                           | 93.2%               | 4.3%       | 2.5%       |
| 1984                                     | 70,663                        | FHWA, MF-33e                 | interpolated                         | 92.7%               | 5.3%       | 2.0%       |
| 1985                                     | 71,518                        | FHWA, MF-33e                 | 1985 RTECS                           | 90.8%               | 7.7%       | 1.5%       |
| 1986                                     | 73,174                        | FHWA, MF-33e                 | interpolated                         | 91.0%               | 7.6%       | 1.4%       |
| 1987                                     | 73,308                        | FHWA, MF-33e                 | interpolated                         | 92.4%               | 6.3%       | 1.3%       |
| 1988                                     | 73,345                        | FHWA, MF-33e                 | 1988 RTECS                           | 91.4%               | 7.4%       | 1.2%       |
| 1989                                     | 73,913                        | FHWA, MF-33e                 | interpolated                         | 92.6%               | 6.2%       | 1.2%       |
| 1990                                     | 69,568                        | FHWA, MF-33e                 | interpolated                         | 92.0%               | 6.8%       | 1.2%       |
| 1991                                     | 64,318                        | FHWA, MF-33e                 | 1991 RTECS                           | 90.8%               | 8.0%       | 1.2%       |
| 1992                                     | 65,436                        | FHWA, MF-33e                 | interpolated                         | 90.8%               | 7.9%       | 1.2%       |
| 1993                                     | 67,047                        | FHWA, MF-33e                 | interpolated                         | 89.7%               | 9.1%       | 1.3%       |
| 1994                                     | 67,874                        | FHWA, MF-33e                 | 1994 RTECS                           | 89.1%               | 9.6%       | 1.3%       |
| 1995                                     | 68,072                        | FHWA, MF-33e                 | interpolated                         | 87.6%               | 11.2%      | 1.2%       |
| 1996                                     | 69,221                        | FHWA, MF-33e                 | interpolated                         | 88.8%               | 10.1%      | 1.0%       |
| 1997                                     | 69,892                        | FHWA, MF-33e                 | interpolated                         | 86.9%               | 12.2%      | 0.9%       |
| 1998                                     | 71,695                        | FHWA, MF-33e                 | interpolated                         | 88.0%               | 11.2%      | 0.8%       |
| 1999                                     | 73,283                        | FHWA, MF-33e                 | interpolated                         | 88.3%               | 11.0%      | 0.6%       |
| 2000                                     | 73,065                        | FHWA, MF-33e                 | 2000 NVPP                            | 86.9%               | 12.6%      | 0.5%       |
| 2001                                     | 73,559                        | FHWA, MF-33e                 | 2001 NVPP                            | 86.5%               | 13.0%      | 0.5%       |
| 2002                                     | 75,471                        | FHWA, MF-33e                 | 2001 NVPP                            | 83.9%               | 15.6%      | 0.5%       |
| 2003                                     | 74,590                        | FHWA, MF-33e                 | 2001 NVPP                            | 75.3%               | 24.2%      | 0.5%       |
| 2004                                     | 75,402                        | FHWA, MF-33e                 | 2001 NVPP                            | 67.2%               | 32.3%      | 0.5%       |
| 2005                                     | 77,418                        | FHWA, MF-33e                 | 2001 NVPP                            | 66.9%               | 32.6%      | 0.5%       |
| 2006                                     | 75,009                        | EIA, C1                      | 2001 NVPP                            | 78.2%               | 21.3%      | 0.5%       |
| 2007                                     | 74,377                        | EIA, C1                      | 2001 NVPP                            | 72.9%               | 26.6%      | 0.5%       |
| 2008                                     | 71,497                        | EIA, C1                      | 2001 NVPP                            | 61.8%               | 37.7%      | 0.5%       |
| 2009                                     | 71,473                        | EIA, C1                      | 2001 NVPP                            | 55.8%               | 43.7%      | 0.5%       |
| Heat content used for conversion to btu: |                               |                              |                                      | 125,000             | 120,900    | 138,700    |
|  |                               |                              |                                      | btu/gallon          | btu/gallon | btu/gallon |

### Motorcycles

DOT, FHWA, *Highway Statistics 2009*, Table VM-1, and annual editions. The FHWA made methodology changes for *Highway Statistics 2009*. At that time, they published historical data back to 2007 which do not match the previous data.

**Table A.2**  
**Motorcycle Fuel Use**

| Year                                     | Fuel use<br>(thousand gallons) | Year               | Fuel use<br>(thousand gallons) |
|--|--------------------------------|--------------------|--------------------------------|
| 1970                                     | 59,580                         | 1990               | 191,140                        |
| 1971                                     | 72,140                         | 1991               | 183,560                        |
| 1972                                     | 86,620                         | 1992               | 191,140                        |
| 1973                                     | 103,880                        | 1993               | 198,120                        |
| 1974                                     | 108,900                        | 1994               | 204,800                        |
| 1975                                     | 112,580                        | 1995               | 198,262                        |
| 1976                                     | 120,060                        | 1996               | 195,940                        |
| 1977                                     | 126,980                        | 1997               | 201,620                        |
| 1978                                     | 143,160                        | 1998               | 205,660                        |
| 1979                                     | 172,740                        | 1999               | 211,680                        |
| 1980                                     | 204,280                        | 2000               | 209,380                        |
| 1981                                     | 213,800                        | 2001               | 192,780                        |
| 1982                                     | 198,200                        | 2002               | 191,040                        |
| 1983                                     | 175,200                        | 2003               | 190,780                        |
| 1984                                     | 175,680                        | 2004               | 202,447                        |
| 1985                                     | 181,720                        | 2005               | 189,495                        |
| 1986                                     | 187,940                        | 2006               | 221,030                        |
| 1987                                     | 190,120                        | 2007               | 474,923                        |
| 1988                                     | 200,480                        | 2008               | 489,419                        |
| 1989                                     | 207,420                        | 2009               | 474,909                        |
| Heat content used for conversion to btu: |                                | 125,000 btu/gallon |                                |

**Buses*****Transit:***

APTA, *2011 Public Transportation Fact Book*, Washington, DC, 2011. Includes motorbus and trolley bus data.

**Table A.3**  
**Transit Bus Fuel Use**

| Year   | LNG<br>(million<br>gallons) | LPG<br>(million<br>gallons) | CNG<br>(million<br>gallons) | Gasoline<br>(million<br>gallons) | Diesel<br>fuel<br>(million<br>gallons) | Electricity<br>(thousand<br>kilowatt<br>hours) | Biodiesel<br>(million<br>gallons) | Methanol<br>(million<br>gallons) |
|--|-----------------------------|-----------------------------|-----------------------------|----------------------------------|--|--|-----------------------------------|----------------------------------|
| 1994   | 1.1                         | 0.2                         | 3.1                         | 2.1                              | 565.1                                  | 102.9  |                                   | 12.5                             |
| 1995   | 1.7                         | 0.3                         | 10.0                        | 2.3                              | 563.8                                  | 100.0  |                                   | 12.0                             |
| 1996   | 2.3                         | 0.6                         | 11.5                        | 1.8                              | 577.7                                  | 69.0   |                                   | 11.6                             |
| 1997   | 3.3                         | 1.0                         | 20.0                        | 2.7                              | 597.6                                  | 78.0   |                                   | 8.7                              |
| 1998   | 3.1                         | 0.9                         | 32.6                        | 2.0                              | 606.6                                  | 74.0   |                                   | 5.0                              |
| 1999   | 5.3                         | 0.8                         | 39.9                        | 1.4                              | 618.0                                  | 75.0   |                                   | 2.7                              |
| 2000   | 10.5                        | 0.7                         | 50.4                        | 1.3                              | 635.2                                  | 77.0   |                                   | 0.8                              |
| 2001   | 11.7                        | 1.2                         | 60.9                        | 1.5                              | 587.2                                  | 74.0   |                                   | 0.8                              |
| 2002   | 16.8                        | 1.8                         | 77.8                        | 1.3                              | 559.0                                  | 73.0   |                                   | 1.8                              |
| 2003   | 14.2                        | 1.8                         | 94.9                        | 1.1                              | 536.0                                  | 69.0   |                                   | 1.9                              |
| 2004   | 16.5                        | 1.7                         | 106.7                       | 1.8                              | 550.5                                  | 68.0   |                                   | 4.7                              |
| 2005   | 18.3                        | 2.0                         | 117.2                       | 1.0                              | 533.8                                  | 67.0   |                                   | 8.1                              |
| 2006   | 19.6                        | 1.6                         | 138.8                       | 2.3                              | 536.7                                  | 62.0   | 20.5                              | 0.9                              |
| 2007   | 18.3                        | <sup>a</sup>                | 129.1                       | 2.5                              | 494.1                                  | 61.0   | 25.8                              | 1.3                              |
| 2008   | 17.9                        | <sup>a</sup>                | 135.5                       | 3.8                              | 493.3                                  | 62.2   | 41.8                              | 0.9                              |
| 2009   | 25.5                        | <sup>a</sup>                | 141.6                       | 6.7                              | 455.5                                  | 69.5   | 40.6                              | 0.0                              |
| Heat content used<br>for conversion<br>to btu: | 84,800<br>btu/gallon        | 91,300<br>btu/gallon        | 138,700<br>btu/gallon       | 125,000<br>btu/gallon            | 138,700<br>btu/gallon                  | 64,600<br>btu/gallon                           |                                   | 10,339<br>but/kWhr               |

**Note:** CNG is reported in diesel-gallon equivalents.

<sup>a</sup> Data are not available.

***Intercity and School:***

Eno Transportation Foundation, *Transportation in America, 2001, Nineteenth Edition*, 2003, Washington, DC, pp. 20–23. School bus fuel was assumed to be 90% diesel fuel and 10% gasoline based on estimates from the National Association of State Directors of Pupil Transportation Services. Intercity bus fuel was assumed to be 100% diesel.

**Table A.4**  
**Intercity and School Bus Fuel Use**

| Year  | Intercity<br>(million gallons) | School<br>(million gallons)              |
|---|--------------------------------|--|
| 1970  | 305.34                         | 299.88                                   |
| 1971  | 296.73                         | 309.75                                   |
| 1972  | 288.12                         | 319.62                                   |
| 1973  | 252.42                         | 327.04                                   |
| 1974  | 216.72                         | 334.46                                   |
| 1975  | 181.02                         | 341.88                                   |
| 1976  | 182.28                         | 389.76                                   |
| 1977  | 181.86                         | 401.52                                   |
| 1978  | 180.18                         | 406.98                                   |
| 1979  | 205.38                         | 404.88                                   |
| 1980  | 213.78                         | 379.68                                   |
| 1981  | 205.38                         | 386.82                                   |
| 1982  | 227.22                         | 398.58                                   |
| 1983  | 237.30                         | 400.68                                   |
| 1984  | 169.26                         | 375.06                                   |
| 1985  | 165.48                         | 425.04                                   |
| 1986  | 148.68                         | 462.42                                   |
| 1987  | 155.82                         | 487.20                                   |
| 1988  | 160.44                         | 511.14                                   |
| 1989  | 166.74                         | 498.12                                   |
| 1990  | 159.60                         | 472.08                                   |
| 1991  | 160.44                         | 533.40                                   |
| 1992  | 157.08                         | 546.00                                   |
| 1993  | 171.36                         | 533.40                                   |
| 1994  | 195.30                         | 546.00                                   |
| 1995  | 195.30                         | 545.16                                   |
| 1996  | 199.92                         | 545.16                                   |
| 1997  | 212.52                         | 544.74                                   |
| 1998  | 220.08                         | 550.20                                   |
| 1999  | 241.08                         | 555.66                                   |
| 2000  | 233.10                         | 577.08                                   |
| 2001  | 204.40*                        | 506.02*                                  |
| 2002  | 209.97*                        | 519.82*                                  |
| 2003  | 210.68*                        | 521.57*                                  |
| 2004  | 212.92*                        | 527.11*                                  |
| 2005  | 207.09*                        | 512.69*                                  |
| 2006  | 221.02*                        | 547.18*                                  |
| 2007  | 228.55*                        | 565.82*                                  |
| 2008  | 233.38*                        | 577.78*                                  |
| 2009  | 226.06*                        | 559.66*                                  |
| Fuel type shares                            | 100% diesel                    | 90% diesel<br>10% gasoline               |
| Heat content used for<br>conversion to btu: | 138,700<br>btu/gallon          | 138,700 btu/gallon<br>125,000 btu/gallon |

\*Estimated using the rate of change of bus vehicle-miles traveled from FHWA Highway Statistics, Table VM-1 (recently revised from 2000-2009).

## Trucks

### Light Trucks:

1970-2008 DOT, FHWA, *Highway Statistics 2008*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary to 1995*. Data for 2009 were estimated; FHWA discontinued light truck fuel use data in 2009. The FHWA discontinued publication of gasohol data in 2005. Therefore, data from EIA, *Alternatives to Traditional Transportation Fuels*, 2006, Table C1, were used.

**Table A.5**  
**Light Truck Fuel Use and Fuel Type Shares for Calculation of Energy Use**

| Year                                     | Fuel use<br>(million<br>gallons) | Source for<br>gasohol shares | Source for<br>gasoline/diesel<br>/lpg shares | Shares by fuel type   |                       |                       |                      |
|--|----------------------------------|------------------------------|--|-----------------------|-----------------------|-----------------------|----------------------|
|  |                                  |                              |  | Gasoline              | Gasohol               | Diesel                | Lpg                  |
| 1970                                     | 12,313                           |                              | 1977 TIUS                                    | 97.6%                 | 0.0%                  | 1.6%                  | 0.8%                 |
| 1971                                     | 13,484                           |                              | 1977 TIUS                                    | 97.6%                 | 0.0%                  | 1.6%                  | 0.8%                 |
| 1972                                     | 15,150                           |                              | 1977 TIUS                                    | 97.6%                 | 0.0%                  | 1.6%                  | 0.8%                 |
| 1973                                     | 16,828                           |                              | 1977 TIUS                                    | 97.6%                 | 0.0%                  | 1.6%                  | 0.8%                 |
| 1974                                     | 16,657                           |                              | 1977 TIUS                                    | 97.6%                 | 0.0%                  | 1.6%                  | 0.8%                 |
| 1975                                     | 19,081                           |                              | 1977 TIUS                                    | 97.6%                 | 0.0%                  | 1.6%                  | 0.8%                 |
| 1976                                     | 20,828                           |                              | 1977 TIUS                                    | 97.6%                 | 0.0%                  | 1.6%                  | 0.8%                 |
| 1977                                     | 22,383                           |                              | 1977 TIUS                                    | 97.6%                 | 0.0%                  | 1.6%                  | 0.8%                 |
| 1978                                     | 24,162                           |                              | Interpolated                                 | 97.1%                 | 0.0%                  | 2.0%                  | 0.9%                 |
| 1979                                     | 24,445                           |                              | Interpolated                                 | 96.7%                 | 0.0%                  | 2.4%                  | 1.0%                 |
| 1980                                     | 23,796                           | FHWA, MF-33e                 | Interpolated                                 | 95.7%                 | 0.5%                  | 2.7%                  | 1.0%                 |
| 1981                                     | 23,697                           | FHWA, MF-33e                 | Interpolated                                 | 95.1%                 | 0.7%                  | 3.1%                  | 1.1%                 |
| 1982                                     | 22,702                           | FHWA, MF-33e                 | 1982 TIUS                                    | 93.0%                 | 2.3%                  | 3.5%                  | 1.2%                 |
| 1983                                     | 23,945                           | FHWA, MF-33e                 | Interpolated                                 | 91.0%                 | 4.3%                  | 3.5%                  | 1.2%                 |
| 1984                                     | 25,604                           | FHWA, MF-33e                 | Interpolated                                 | 90.0%                 | 5.3%                  | 3.5%                  | 1.2%                 |
| 1985                                     | 27,363                           | FHWA, MF-33e                 | Interpolated                                 | 87.6%                 | 7.7%                  | 3.5%                  | 1.2%                 |
| 1986                                     | 29,074                           | FHWA, MF-33e                 | Interpolated                                 | 87.7%                 | 7.6%                  | 3.5%                  | 1.2%                 |
| 1987                                     | 30,598                           | FHWA, MF-33e                 | 1987 TIUS                                    | 89.0%                 | 6.3%                  | 3.5%                  | 1.2%                 |
| 1988                                     | 32,653                           | FHWA, MF-33e                 | Interpolated                                 | 88.2%                 | 7.4%                  | 3.5%                  | 1.0%                 |
| 1989                                     | 33,271                           | FHWA, MF-33e                 | Interpolated                                 | 89.5%                 | 6.2%                  | 3.4%                  | 0.8%                 |
| 1990                                     | 35,611                           | FHWA, MF-33e                 | Interpolated                                 | 89.2%                 | 6.8%                  | 3.4%                  | 0.7%                 |
| 1991                                     | 38,217                           | FHWA, MF-33e                 | Interpolated                                 | 88.1%                 | 8.0%                  | 3.3%                  | 0.5%                 |
| 1992                                     | 40,929                           | FHWA, MF-33e                 | 1992 TIUS                                    | 88.5%                 | 7.9%                  | 3.3%                  | 0.3%                 |
| 1993                                     | 42,851                           | FHWA, MF-33e                 | Interpolated                                 | 87.3%                 | 9.1%                  | 3.3%                  | 0.3%                 |
| 1994                                     | 44,112                           | FHWA, MF-33e                 | Interpolated                                 | 86.8%                 | 9.6%                  | 3.3%                  | 0.3%                 |
| 1995                                     | 45,605                           | FHWA, MF-33e                 | Interpolated                                 | 85.1%                 | 11.2%                 | 3.4%                  | 0.3%                 |
| 1996                                     | 47,354                           | FHWA, MF-33e                 | Interpolated                                 | 86.2%                 | 10.1%                 | 3.4%                  | 0.3%                 |
| 1997                                     | 49,388                           | FHWA, MF-33e                 | 1997 VIUS                                    | 84.2%                 | 12.2%                 | 3.4%                  | 0.2%                 |
| 1998                                     | 50,462                           | FHWA, MF-33e                 | Interpolated                                 | 85.0%                 | 11.2%                 | 3.5%                  | 0.3%                 |
| 1999                                     | 52,859                           | FHWA, MF-33e                 | Interpolated                                 | 84.9%                 | 11.0%                 | 3.6%                  | 0.4%                 |
| 2000                                     | 52,939                           | FHWA, MF-33e                 | Interpolated                                 | 83.1%                 | 12.6%                 | 3.8%                  | 0.6%                 |
| 2001                                     | 53,522                           | FHWA, MF-33e                 | Interpolated                                 | 82.4%                 | 13.0%                 | 3.9%                  | 0.7%                 |
| 2002                                     | 55,220                           | FHWA, MF-33e                 | 2002 VIUS                                    | 79.6%                 | 15.6%                 | 4.0%                  | 0.8%                 |
| 2003                                     | 60,758                           | FHWA, MF-33e                 | 2002 VIUS                                    | 71.0%                 | 24.2%                 | 4.0%                  | 0.8%                 |
| 2004                                     | 63,417                           | FHWA, MF-33e                 | 2002 VIUS                                    | 62.9%                 | 32.3%                 | 4.0%                  | 0.8%                 |
| 2005                                     | 58,869                           | FHWA, MF-33e                 | 2002 VIUS                                    | 62.6%                 | 32.6%                 | 4.0%                  | 0.8%                 |
| 2006                                     | 60,685                           | EIA, C1                      | 2002 VIUS                                    | 73.9%                 | 21.3%                 | 4.0%                  | 0.8%                 |
| 2007                                     | 61,836                           | EIA, C1                      | 2002 VIUS                                    | 68.6%                 | 26.6%                 | 4.0%                  | 0.8%                 |
| 2008                                     | 61,199                           | EIA, C1                      | 2002 VIUS                                    | 57.5%                 | 37.7%                 | 4.0%                  | 0.8%                 |
| 2009                                     | 61,610                           | EIA, C1                      | 2002 VIUS                                    | 51.5%                 | 43.7%                 | 4.0%                  | 0.8%                 |
| Heat content used for conversion to btu: |                                  |                              |  | 125,000<br>btu/gallon | 120,900<br>btu/gallon | 138,700<br>btu/gallon | 90,800<br>btu/gallon |

**Medium/Heavy Trucks:**

DOT, FHWA, *Highway Statistics 2009*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary to 1995*. The FHWA made methodology changes for *Highway Statistics 2009*. At that time, they published historical data back to 2007 which do not match the previous data. Total gallons for medium/heavy trucks are the sum of single-unit trucks and combination trucks.

**Table A.6**  
**Medium/Heavy Truck Fuel Use and Fuel Type Shares**  
**for Calculation of Energy Use**

| Year                                     | Fuel use<br>(million gallons) | Source for<br>gasoline/diesel/lpg<br>shares | Shares by fuel type |            |            |
|--|-------------------------------|---|---------------------|------------|------------|
|  |                               |   | Gasoline            | Diesel     | Lpg        |
| 1970                                     | 11,316                        | 1977 TIUS                                   | 10.4%               | 89.5%      | 0.1%       |
| 1971                                     | 11,812                        | 1977 TIUS                                   | 10.4%               | 89.5%      | 0.1%       |
| 1972                                     | 12,964                        | 1977 TIUS                                   | 10.4%               | 89.5%      | 0.1%       |
| 1973                                     | 14,320                        | 1977 TIUS                                   | 10.4%               | 89.5%      | 0.1%       |
| 1974                                     | 14,341                        | 1977 TIUS                                   | 10.4%               | 89.5%      | 0.1%       |
| 1975                                     | 14,598                        | 1977 TIUS                                   | 10.4%               | 89.5%      | 0.1%       |
| 1976                                     | 15,408                        | 1977 TIUS                                   | 10.4%               | 89.5%      | 0.1%       |
| 1977                                     | 17,082                        | 1977 TIUS                                   | 10.4%               | 89.5%      | 0.1%       |
| 1978                                     | 19,121                        | Interpolated                                | 16.2%               | 83.5%      | 0.3%       |
| 1979                                     | 19,913                        | Interpolated                                | 22.1%               | 77.5%      | 0.5%       |
| 1980                                     | 19,960                        | Interpolated                                | 27.9%               | 71.4%      | 0.6%       |
| 1981                                     | 20,376                        | Interpolated                                | 33.8%               | 65.4%      | 0.8%       |
| 1982                                     | 20,386                        | 1982 TIUS                                   | 39.6%               | 59.4%      | 1.0%       |
| 1983                                     | 20,761                        | Interpolated                                | 35.6%               | 63.6%      | 0.8%       |
| 1984                                     | 21,428                        | Interpolated                                | 31.5%               | 67.8%      | 0.7%       |
| 1985                                     | 21,405                        | Interpolated                                | 27.5%               | 72.0%      | 0.5%       |
| 1986                                     | 21,861                        | Interpolated                                | 23.4%               | 76.2%      | 0.4%       |
| 1987                                     | 22,513                        | 1987 TIUS                                   | 19.4%               | 80.4%      | 0.2%       |
| 1988                                     | 22,925                        | Interpolated                                | 18.8%               | 81.0%      | 0.3%       |
| 1989                                     | 23,512                        | Interpolated                                | 18.1%               | 81.6%      | 0.3%       |
| 1990                                     | 24,490                        | Interpolated                                | 17.5%               | 82.1%      | 0.4%       |
| 1991                                     | 24,981                        | Interpolated                                | 16.8%               | 82.7%      | 0.4%       |
| 1992                                     | 25,453                        | 1992 TIUS                                   | 16.2%               | 83.3%      | 0.5%       |
| 1993                                     | 26,236                        | Interpolated                                | 15.4%               | 84.1%      | 0.5%       |
| 1994                                     | 27,685                        | Interpolated                                | 14.7%               | 84.8%      | 0.5%       |
| 1995                                     | 28,828                        | Interpolated                                | 13.9%               | 85.6%      | 0.5%       |
| 1996                                     | 29,601                        | Interpolated                                | 13.2%               | 86.3%      | 0.5%       |
| 1997                                     | 29,878                        | 1997 VIUS                                   | 12.4%               | 87.1%      | 0.5%       |
| 1998                                     | 30,841                        | Interpolated                                | 12.1%               | 87.4%      | 0.5%       |
| 1999                                     | 33,909                        | Interpolated                                | 11.8%               | 87.6%      | 0.5%       |
| 2000                                     | 35,229                        | Interpolated                                | 11.6%               | 87.9%      | 0.5%       |
| 2001                                     | 35,179                        | Interpolated                                | 11.3%               | 88.1%      | 0.5%       |
| 2002                                     | 36,800                        | 2002 VIUS                                   | 11.0%               | 88.4%      | 0.5%       |
| 2003                                     | 35,775                        | 2002 VIUS                                   | 11.0%               | 88.4%      | 0.5%       |
| 2004                                     | 33,150                        | 2002 VIUS                                   | 11.0%               | 88.4%      | 0.5%       |
| 2005                                     | 37,190                        | 2002 VIUS                                   | 11.0%               | 88.4%      | 0.5%       |
| 2006                                     | 37,959                        | 2002 VIUS                                   | 11.0%               | 88.4%      | 0.5%       |
| 2007                                     | 47,218                        | 2002 VIUS                                   | 11.0%               | 88.4%      | 0.5%       |
| 2008                                     | 47,705                        | 2002 VIUS                                   | 11.0%               | 88.4%      | 0.5%       |
| 2009                                     | 44,472                        | 2002 VIUS                                   | 11.0%               | 88.4%      | 0.5%       |
| Heat content used for conversion to btu: |                               |   | 125,000             | 138,700    | 90,800     |
|  |                               |   | btu/gallon          | btu/gallon | btu/gallon |

## Off-highway energy use

U.S. Environmental Protection Agency, NONROAD2008a model, results generated April 2011. Gallons of fuel by fuel type were produced for agricultural equipment, airport equipment, construction and mining equipment, industrial equipment, lawn and garden equipment, logging equipment, railroad maintenance equipment, and recreational equipment. Some non-transportation-related equipment, such as generators, chain saws, compressors, and pumps, were excluded from the data.

## Nonhighway energy use

### Air

#### *General Aviation:*

DOT, FAA, *General Aviation Activity and Avionics Survey: Annual Summary Report Calendar Year 2009*, Table 5.1, and annual.

**Table A.7**  
**General Aviation Fuel Use**

| Year  | Jet fuel<br>(million gallons) | Aviation gasoline<br>(million gallons) |
|---|-------------------------------|--|
| 1970  | 208.0                         | 551.0                                  |
| 1971  | 226.0                         | 508.0                                  |
| 1972  | 245.0                         | 584.0                                  |
| 1973  | 304.0                         | 411.0                                  |
| 1974  | 357.0                         | 443.0                                  |
| 1975  | 453.0                         | 412.0                                  |
| 1976  | 495.0                         | 432.0                                  |
| 1977  | 536.0                         | 456.0                                  |
| 1978  | 763.0                         | 518.0                                  |
| 1979  | 736.0                         | 570.0                                  |
| 1980  | 766.0                         | 520.0                                  |
| 1981  | 759.0                         | 489.0                                  |
| 1982  | 887.0                         | 448.0                                  |
| 1983  | 613.0                         | 428.0                                  |
| 1984  | 738.9                         | 462.4                                  |
| 1985  | 691.0                         | 421.0                                  |
| 1986  | 732.1                         | 408.6                                  |
| 1987  | 672.7                         | 401.8                                  |
| 1988  | 746.0                         | 398.0                                  |
| 1989  | 688.0                         | 342.8                                  |
| 1990  | 662.0                         | 353.0                                  |
| 1991  | 579.0                         | 348.0                                  |
| 1992  | 496.0                         | 306.0                                  |
| 1993  | 454.1                         | 268.4                                  |
| 1994  | 470.8                         | 264.1                                  |
| 1995  | 544.0                         | 276.0                                  |
| 1996  | 567.5                         | 286.5                                  |
| 1997  | 639.4                         | 289.7                                  |
| 1998  | 814.6                         | 311.4                                  |
| 1999  | 967.2                         | 345.4                                  |
| 2000  | 998.1                         | 336.3                                  |
| 2001  | 938.7                         | 319.3                                  |
| 2002  | 815.5                         | 261.4                                  |
| 2003  | 820.0                         | 255.5                                  |
| 2004  | 1,075.2                       | 256.1                                  |
| 2005  | 1,507.4                       | 323.6                                  |
| 2006  | 1,636.3                       | 294.7                                  |
| 2007  | 1,516.3                       | 314.8                                  |
| 2008  | 1,688.6                       | 306.3                                  |
| 2009  | 1,350.6                       | 312.0                                  |
| Heat content used for<br>conversion to btu: | 135,000 btu/gallon            | 120,200<br>btu/gallon                  |

***Domestic and International Air Carrier:***

DOT, Bureau of Transportation Statistics, "Fuel Cost and Consumption Tables," [www.bts.gov/xml/fuel/report/src/index.xml](http://www.bts.gov/xml/fuel/report/src/index.xml). The table below shows all international fuel use. Because the data for international include fuel purchased abroad, for the tables in Chapter 2, the international total was divided in half to estimate domestic fuel use for international flights.

**Table A.8**  
**Air Carrier Fuel Use**

| Year  | Domestic<br>(thousand gallons)  | International<br>(thousand gallons) | Total<br>(thousand gallons) |
|---|---|-------------------------------------|-----------------------------|
| 1970  |   |                                     | 10,085,000                  |
| 1971  |   |                                     | 10,140,000                  |
| 1972  | Separate estimates for domestic<br>and international are not available<br>from 1970-1976. |                                     | 10,302,000                  |
| 1973  |   |                                     | 10,671,000                  |
| 1974  |   |                                     | 10,417,260                  |
| 1975  |   |                                     | 10,412,640                  |
| 1976  |   |                                     | 10,400,040                  |
| 1977  | 8,202,051   | 1,708,376                           | 9,910,427                   |
| 1978  | 8,446,117   | 1,741,918                           | 10,188,035                  |
| 1979  | 8,865,885   | 1,828,435                           | 10,694,320                  |
| 1980  | 8,519,233   | 1,747,306                           | 10,266,539                  |
| 1981  | 8,555,249   | 2,032,520                           | 10,587,769                  |
| 1982  | 8,432,465   | 1,967,733                           | 10,400,198                  |
| 1983  | 8,672,574   | 1,998,289                           | 10,670,863                  |
| 1984  | 9,625,958   | 2,286,407                           | 11,912,365                  |
| 1985  | 10,115,007  | 2,487,929                           | 12,602,936                  |
| 1986  | 11,137,331  | 2,544,996                           | 13,682,327                  |
| 1987  | 11,586,838  | 2,893,617                           | 14,480,455                  |
| 1988  | 11,917,904  | 3,262,824                           | 15,180,728                  |
| 1989  | 11,905,144  | 3,557,294                           | 15,462,438                  |
| 1990  | 12,429,305  | 3,963,081                           | 16,392,386                  |
| 1991  | 11,506,477  | 3,939,666                           | 15,446,144                  |
| 1992  | 11,762,852  | 4,120,132                           | 15,882,983                  |
| 1993  | 11,958,663  | 4,113,321                           | 16,071,984                  |
| 1994  | 12,475,549  | 4,310,879                           | 16,786,428                  |
| 1995  | 12,811,717  | 4,511,418                           | 17,323,135                  |
| 1996  | 13,187,305  | 4,658,093                           | 17,845,398                  |
| 1997  | 13,659,581  | 4,964,181                           | 18,623,762                  |
| 1998  | 13,876,971  | 5,185,562                           | 19,062,533                  |
| 1999  | 14,402,127  | 5,250,492                           | 19,652,619                  |
| 2000  | 14,844,592  | 5,474,685                           | 20,319,277                  |
| 2001  | 14,017,461  | 5,237,487                           | 19,254,948                  |
| 2002  | 12,848,329  | 4,990,798                           | 17,839,127                  |
| 2003  | 12,958,581  | 4,836,356                           | 17,794,936                  |
| 2004  | 13,622,603  | 4,931,546                           | 18,554,149                  |
| 2005  | 13,778,869  | 5,520,889                           | 19,309,758                  |
| 2006  | 13,694,437  | 6,017,638                           | 19,712,075                  |
| 2007  | 13,681,664  | 6,204,502                           | 19,886,165                  |
| 2008  | 12,666,911  | 6,186,747                           | 18,853,658                  |
| 2009  | 11,339,220  | 5,721,298                           | 17,060,517                  |
| Heat content used for<br>conversion to btu: | 135,000<br>btu/gallon   | 135,000<br>btu/gallon               | 135,000<br>btu/gallon       |



**Water****Freight:**

Total – DOE, EIA, *Fuel Oil and Kerosene Sales* 2009, Table 13. Adjusted sales of distillate and residual fuel oil for vessel bunkering. (This may include some amounts of bunker fuels used for recreational purposes.)

**Table A.9**  
**Diesel and Residual Fuel Oil for Vessel Bunkering**

| Year  | Distillate fuel oil<br>(thousand gallons) | Residual fuel oil<br>(thousand gallons) |
|---|---|---|
| 1970  | 819,000                                   | 3,774,120                               |
| 1971  | 880,000                                   | 3,307,000                               |
| 1972  | 1,013,000                                 | 3,273,000                               |
| 1973  | 1,125,000                                 | 3,859,000                               |
| 1974  | 1,018,920                                 | 3,827,040                               |
| 1975  | 1,097,880                                 | 4,060,140                               |
| 1976  | 1,220,100                                 | 4,977,000                               |
| 1977  | 1,407,420                                 | 5,416,740                               |
| 1978  | 1,578,822                                 | 6,614,790                               |
| 1979  | 1,630,858                                 | 8,002,672                               |
| 1980  | 717,376                                   | 7,454,242                               |
| 1981  | 1,723,143                                 | 7,922,512                               |
| 1982  | 1,423,216                                 | 6,408,818                               |
| 1983  | 1,418,890                                 | 5,724,115                               |
| 1984  | 1,692,045                                 | 5,688,931                               |
| 1985  | 1,894,265                                 | 5,269,733                               |
| 1986  | 2,034,215                                 | 5,690,250                               |
| 1987  | 2,223,258                                 | 5,869,154                               |
| 1988  | 2,310,367                                 | 6,025,511                               |
| 1989  | 2,356,444                                 | 6,621,100                               |
| 1990  | 2,197,004                                 | 6,248,095                               |
| 1991  | 2,167,640                                 | 6,786,055                               |
| 1992  | 2,240,170                                 | 7,199,078                               |
| 1993  | 2,043,745                                 | 6,269,882                               |
| 1994  | 2,026,899                                 | 5,944,383                               |
| 1995  | 1,978,105                                 | 6,431,238                               |
| 1996  | 2,177,608                                 | 5,804,977                               |
| 1997  | 2,107,561                                 | 4,789,861                               |
| 1998  | 2,125,568                                 | 4,640,153                               |
| 1999  | 2,064,590                                 | 5,598,630                               |
| 2000  | 2,041,433                                 | 6,192,294                               |
| 2001  | 2,099,011                                 | 4,345,284                               |
| 2002  | 2,056,465                                 | 4,783,956                               |
| 2003  | 1,863,150                                 | 3,801,425                               |
| 2004  | 2,313,448                                 | 4,886,978                               |
| 2005  | 2,115,381                                 | 5,533,552                               |
| 2006  | 2,206,690                                 | 6,000,434                               |
| 2007  | 2,158,930                                 | 6,773,950                               |
| 2008  | 1,365,351                                 | 6,230,994                               |
| 2009  | 1,486,802                                 | 5,607,263                               |
| Heat content used for<br>conversion to btu: | 138,700<br>btu/gallon                     | 149,700<br>btu/gallon                   |
| Domestic share of total<br>fuel use         | 77.5%                                     | 9.3%                                    |

**Recreational Boating:**

Fuel use by recreational boating comes from the EPA's NONROAD2008A model.

**Table A.10**  
**Recreational Boating Fuel Use**

| Year  | Diesel use<br>(gallons) | Gasoline use<br>(gallons) |
|---|-------------------------|---------------------------|
| 1970  | 39,589,953              | 1,213,397,311             |
| 1971  | 47,130,906              | 1,220,995,448             |
| 1972  | 54,671,856              | 1,228,593,572             |
| 1973  | 62,212,803              | 1,236,191,635             |
| 1974  | 69,753,735              | 1,243,789,752             |
| 1975  | 77,294,680              | 1,251,387,972             |
| 1976  | 84,835,632              | 1,258,986,070             |
| 1977  | 92,376,573              | 1,266,584,111             |
| 1978  | 99,917,523              | 1,274,182,341             |
| 1979  | 107,458,470             | 1,281,780,460             |
| 1980  | 114,999,421             | 1,289,378,532             |
| 1981  | 122,540,357             | 1,296,976,672             |
| 1982  | 130,081,302             | 1,304,574,832             |
| 1983  | 137,622,248             | 1,312,172,890             |
| 1984  | 145,163,202             | 1,319,771,007             |
| 1985  | 152,704,140             | 1,327,369,146             |
| 1986  | 160,245,074             | 1,334,967,322             |
| 1987  | 167,786,030             | 1,342,565,455             |
| 1988  | 175,326,970             | 1,362,856,034             |
| 1989  | 182,867,916             | 1,383,146,636             |
| 1990  | 190,408,869             | 1,403,437,194             |
| 1991  | 197,949,808             | 1,429,688,292             |
| 1992  | 205,490,749             | 1,455,939,504             |
| 1993  | 213,031,707             | 1,482,190,597             |
| 1994  | 220,572,649             | 1,539,794,180             |
| 1995  | 228,113,596             | 1,597,269,921             |
| 1996  | 235,654,521             | 1,654,446,069             |
| 1997  | 243,195,481             | 1,657,737,628             |
| 1998  | 250,736,414             | 1,659,056,085             |
| 1999  | 258,159,525             | 1,657,198,161             |
| 2000  | 265,582,657             | 1,652,906,973             |
| 2001  | 273,547,835             | 1,655,303,922             |
| 2002  | 281,512,965             | 1,653,583,696             |
| 2003  | 289,478,093             | 1,648,070,959             |
| 2004  | 297,443,197             | 1,639,713,127             |
| 2005  | 305,408,463             | 1,629,873,278             |
| 2006  | 313,420,594             | 1,619,603,593             |
| 2007  | 321,432,801             | 1,609,567,873             |
| 2008  | 329,445,068             | 1,599,830,522             |
| 2009  | 337,457,287             | 1,590,749,216             |
| Heat content used for<br>conversion to btu: | 138,700<br>btu/gallon   | 125,000<br>btu/gallon     |

## Pipeline

The sum of natural gas, crude petroleum and petroleum product, and coal slurry and water.

### ***Natural Gas:***

The amount of natural gas used to transport natural gas was defined as "pipeline fuel" as reported in DOE, EIA, *Natural Gas Annual 2009*, Table 1. Cubic feet were converted to Btu using 1,031 Btu/ft<sup>3</sup>. Electricity use was estimated using the following procedure as reported on p. 5-110 of J. N. Hooker et al., *End Use Energy Consumption DataBase: Transportation Sector*. The energy consumption of a natural gas pipeline was taken to be the energy content of the fuel used to drive the pumps. Some 94% of the installed pumping horsepower was supplied by natural gas. The remaining 6% of the horsepower was generated more efficiently, mostly by electric motors. The energy consumed by natural gas pipeline pumps that were electrically powered was not known. In order to estimate the electricity consumed, the Btu of natural gas pipeline fuel consumed was multiplied by a factor of 0.015. From this computed value, electricity efficiency and generation loss must be taken into account. The electricity energy use in Btu must be converted to kWhr, using the conversion factor  $29.305 \times 10^{-5}$  kWhr/Btu. Electricity generation and distribution efficiency was 29%. When generation and distribution efficiency are taken into account, 1 kWhr equals 10,339 Btu.

### ***Crude petroleum and petroleum product:***

J. N. Hooker, *Oil Pipeline Energy Consumption and Efficiency*, ORNL-5697, ORNL, Oak Ridge, TN, 1981. (Data held constant; Latest available data.)

### ***Coal slurry and water:***

W. F. Banks, Systems, Science and Software, *Energy Consumption in the Pipeline Industry*, LaJolla, CA, October 1977. (Data held constant; Latest available data.)

**Table A.11**  
**Pipeline Fuel Use**

| Year  | Natural gas<br>(million cubic<br>feet) | Estimated natural<br>gas pipeline<br>electricity use<br>(million kWhr) | Electricity<br>constant (btu) |
|---|--|--|-------------------------------|
| 1970  | 722,166                                | 3,272.9  | 212.1                         |
| 1971  | 742,592                                | 3,365.4  | 212.1                         |
| 1972  | 766,156                                | 3,472.2  | 212.1                         |
| 1973  | 728,177                                | 3,300.1  | 212.1                         |
| 1974  | 668,792                                | 3,031.0  | 212.1                         |
| 1975  | 582,963                                | 2,642.0  | 212.1                         |
| 1976  | 548,323                                | 2,485.0  | 212.1                         |
| 1977  | 532,669                                | 2,414.1  | 212.1                         |
| 1978  | 530,451                                | 2,404.0  | 212.1                         |
| 1979  | 600,964                                | 2,723.6  | 212.1                         |
| 1980  | 634,622                                | 2,876.1  | 212.1                         |
| 1981  | 642,325                                | 2,911.0  | 212.1                         |
| 1982  | 596,411                                | 2,703.0  | 212.1                         |
| 1983  | 490,042                                | 2,220.9  | 212.1                         |
| 1984  | 528,754                                | 2,396.3  | 212.1                         |
| 1985  | 503,766                                | 2,283.1  | 212.1                         |
| 1986  | 485,041                                | 2,198.2  | 212.1                         |
| 1987  | 519,170                                | 2,352.9  | 212.1                         |
| 1988  | 613,912                                | 2,782.3  | 212.1                         |
| 1989  | 629,308                                | 2,852.0  | 212.1                         |
| 1990  | 659,816                                | 2,990.3  | 212.1                         |
| 1991  | 601,305                                | 2,725.1  | 212.1                         |
| 1992  | 587,710                                | 2,663.5  | 212.1                         |
| 1993  | 624,308                                | 2,829.4  | 212.1                         |
| 1994  | 685,362                                | 3,106.1  | 212.1                         |
| 1995  | 700,335                                | 3,173.9  | 212.1                         |
| 1996  | 711,446                                | 3,224.3  | 212.1                         |
| 1997  | 751,470                                | 3,405.7  | 212.1                         |
| 1998  | 635,477                                | 2,880.0  | 212.1                         |
| 1999  | 645,319                                | 2,924.6  | 212.1                         |
| 2000  | 642,210                                | 2,910.5  | 212.1                         |
| 2001  | 624,964                                | 2,832.3  | 212.1                         |
| 2002  | 666,920                                | 3,022.5  | 212.1                         |
| 2003  | 591,492                                | 2,680.7  | 212.1                         |
| 2004  | 566,187                                | 2,566.0  | 212.1                         |
| 2005  | 584,026                                | 2,646.8  | 212.1                         |
| 2006  | 584,213                                | 2,647.7  | 212.1                         |
| 2007  | 621,364                                | 2,816.0  | 212.1                         |
| 2008  | 647,956                                | 2,936.6  | 212.1                         |
| 2009  | 598,216                                | 2,711.1  | 212.1                         |
| Heat content used for<br>conversion to btu: | 1,031<br>btu/cubic foot                | 10,339<br>Btu/kWhr   |                               |

**Note:** Formula for estimating electricity use for natural gas pipelines is:  
 Natural gas use (in million cubic ft)  $\times$  1,031 btu/cubic ft  $\times$  0.015  $\times$  29.305  $\times$  10<sup>-5</sup> kWhr/btu

**Rail*****Freight:***AAR, *Railroad Facts*, 2010 Edition, Washington, DC, 2010.

**Table A.12**  
**Class I Freight Railroad Fuel Use**

| Year  | Diesel fuel<br>(thousand gallons) |
|---|-----------------------------------|
| 1970  | 3,807,663                         |
| 1971  | 3,822,907                         |
| 1972  | 3,996,985                         |
| 1973  | 4,160,730                         |
| 1974  | 4,175,375                         |
| 1975  | 3,736,484                         |
| 1976  | 3,895,542                         |
| 1977  | 3,985,069                         |
| 1978  | 3,968,007                         |
| 1979  | 4,072,187                         |
| 1980  | 3,955,996                         |
| 1981  | 3,756,439                         |
| 1982  | 3,178,116                         |
| 1983  | 3,137,295                         |
| 1984  | 3,388,173                         |
| 1985  | 3,144,190                         |
| 1986  | 3,039,069                         |
| 1987  | 3,102,227                         |
| 1988  | 3,182,267                         |
| 1989  | 3,190,815                         |
| 1990  | 3,134,446                         |
| 1991  | 2,925,970                         |
| 1992  | 3,022,108                         |
| 1993  | 3,111,981                         |
| 1994  | 3,355,802                         |
| 1995  | 3,503,096                         |
| 1996  | 3,600,649                         |
| 1997  | 3,602,793                         |
| 1998  | 3,619,341                         |
| 1999  | 3,749,428                         |
| 2000  | 3,720,107                         |
| 2001  | 3,729,985                         |
| 2002  | 3,751,413                         |
| 2003  | 3,849,229                         |
| 2004  | 4,082,236                         |
| 2005  | 4,119,879                         |
| 2006  | 4,214,459                         |
| 2007  | 4,087,405                         |
| 2008  | 3,911,178                         |
| 2009  | 3,220,059                         |
| Heat content used for<br>conversion to btu: | 138,700<br>Btu/gallon             |

**Passenger:**

*Commuter - APTA, Public Transportation Fact Book, 2011, Washington, DC, 2011.*

**Table A.13**  
**Commuter Rail Fuel Use**

| Year  | Diesel<br>(thousand gallons) | Electricity<br>(million kWhr) |
|---|------------------------------|-------------------------------|
| 1984  | 58,320                       | 901                           |
| 1985  | 55,372                       | 1,043                         |
| 1986  | 54,608                       | 1,170                         |
| 1987  | 51,594                       | 1,155                         |
| 1988  | 53,054                       | 1,195                         |
| 1989  | 52,516                       | 1,293                         |
| 1990  | 52,681                       | 1,226                         |
| 1991  | 54,315                       | 1,239                         |
| 1992  | 54,951                       | 1,124                         |
| 1993  | 59,766                       | 1,196                         |
| 1994  | 61,900                       | 1,244                         |
| 1995  | 63,064                       | 1,253                         |
| 1996  | 61,888                       | 1,255                         |
| 1997  | 63,195                       | 1,270                         |
| 1998  | 69,200                       | 1,299                         |
| 1999  | 73,005                       | 1,322                         |
| 2000  | 70,818                       | 1,370                         |
| 2001  | 72,204                       | 1,354                         |
| 2002  | 72,847                       | 1,334                         |
| 2003  | 72,264                       | 1,383                         |
| 2004  | 71,999                       | 1,449                         |
| 2005  | 76,714                       | 1,484                         |
| 2006  | 78,600                       | 1,478                         |
| 2007  | 80,700                       | 1,763                         |
| 2008  | 83,500                       | 1,718                         |
| 2009  | 95,000                       | 1,780                         |
| Heat content used for<br>conversion to btu: | 138,700<br>Btu/gallon        | 10,339<br>Btu/kWhr            |

*Transit* – APTA, *Public Transportation Fact Book*, 2011, Washington, DC, 2011.  
Includes light rail and heavy rail.

**Table A.14**  
**Transit Rail Fuel Use**

| Year  | Electricity (million kWhr)   |                    |                    |
|---|--|--------------------|--------------------|
|   | Light rail   | Heavy rail         | Total              |
| 1970  |  |                    | 2,561              |
| 1971  |  |                    | 2,556              |
| 1972  |  |                    | 2,428              |
| 1973  |  |                    | 2,331              |
| 1974  |  |                    | 2,630              |
| 1975  |  |                    | 2,646              |
| 1976  | Light rail and heavy rail data are<br>not available separately from<br>1970 to 1985. |                    | 2,576              |
| 1977  |  |                    | 2,303              |
| 1978  |  |                    | 2,223              |
| 1979  |  |                    | 2,473              |
| 1980  |  |                    | 2,446              |
| 1981  |  |                    | 2,655              |
| 1982  |  |                    | 2,722              |
| 1983  |  |                    | 2,930              |
| 1984  |  |                    | 3,092              |
| 1985  |  |                    | 2,928              |
| 1986  | 173  | 3,066              | 3,239              |
| 1987  | 191  | 3,219              | 3,410              |
| 1988  | 243  | 3,256              | 3,499              |
| 1989  | 242  | 3,286              | 3,528              |
| 1990  | 239  | 3,284              | 3,523              |
| 1991  | 274  | 3,248              | 3,522              |
| 1992  | 297  | 3,193              | 3,490              |
| 1993  | 281  | 3,287              | 3,568              |
| 1994  | 282  | 3,431              | 3,713              |
| 1995  | 288  | 3,401              | 3,689              |
| 1996  | 321  | 3,322              | 3,643              |
| 1997  | 363  | 3,253              | 3,616              |
| 1998  | 382  | 3,280              | 3,662              |
| 1999  | 416  | 3,385              | 3,801              |
| 2000  | 563  | 3,549              | 4,112              |
| 2001  | 587  | 3,646              | 4,233              |
| 2002  | 510  | 3,683              | 4,193              |
| 2003  | 507  | 3,632              | 4,138              |
| 2004  | 553  | 3,684              | 4,237              |
| 2005  | 571  | 3,769              | 4,339              |
| 2006  | 634  | 3,709              | 4,343              |
| 2007  | 687  | 3,817              | 4,505              |
| 2008  | 721  | 3,898              | 4,619              |
| 2009  | 738  | 3,866              | 4,624              |
| Heat content used for<br>conversion to btu: | 10,339<br>Btu/kWhr   | 10,339<br>Btu/kWhr | 10,339<br>Btu/kWhr |

*Intercity* – Personal communication with Amtrak, Washington, DC, 2011.

**Table A.15**  
**Intercity Rail Fuel Use**

| Year                                       | Diesel fuel<br>(thousand<br>gallons) | Electricity<br>(thousand kWhr) |
|--|--------------------------------------|--------------------------------|
| 1994                                       | 73,516                               | 308,948                        |
| 1995                                       | 72,371                               | 335,818                        |
| 1996                                       | 71,226                               | 362,689                        |
| 1997                                       | 75,656                               | 389,559                        |
| 1998                                       | 75,999                               | 416,429                        |
| 1999                                       | 79,173                               | 443,300                        |
| 2000                                       | 94,968                               | 470,170                        |
| 2001                                       | 96,846                               | 455,703                        |
| 2002                                       | 84,432                               | 518,306                        |
| 2003                                       | 74,621                               | 536,950                        |
| 2004                                       | 68,605                               | 550,695                        |
| 2005                                       | 65,477                               | 531,377                        |
| 2006                                       | 62,463                               | 548,856                        |
| 2007                                       | 61,824                               | 577,864                        |
| 2008                                       | 63,428                               | 582,022                        |
| 2009                                       | 61,704                               | 564,968                        |
| Heat content used for<br>conversion to Btu | 138,700<br>Btu/gallon                | 10,339<br>Btu/kWhr             |

### **Calculation of Million Barrels per Day Crude Oil Equivalent**

One gallon of gasoline, diesel fuel, or lpg is estimated to be the equivalent of one gallon of crude oil. Petroleum used for electricity was calculated using the following formula:

$$(([(BTU*S)/G ]/P }/365)/1000$$

- BTU = Btus of electricity from Table 2.5  
 S = Share of petroleum used in making primary electricity (Calculated from Table 2.6 from the EIA, Monthly Energy Review)  
 G = Electricity generation and distribution (assumed 29%)  
 P = Btus per barrel of petroleum product (Table A3 from the EIA, Monthly Energy Review).



## Passenger Travel and Energy Use

### Automobiles

**Number of vehicles, vehicle-miles** – DOT, FHWA, *Highway Statistics, 2009*, Table VM-1. Data series shown in Table 4.1.

**Passenger-miles** – Vehicle-miles multiplied by an average load factor.

**Load factor** – 2009 NHTS shows automobile load factor as 1.55 persons per vehicle (preliminary).

**Energy intensities** –

*Btu per vehicle-mile* – Automobile energy use divided by vehicle-miles.

*Btu per passenger-mile* – Automobile energy use divided by passenger-miles.

**Energy use** – See Energy Use Sources, p. A-5. Data series shown in Table 2.7.

### Light Trucks

**Number of vehicles, vehicle-miles** – DOT, FHWA, *Highway Statistics 2009*, Table VM-1. Data by truck type were multiplied by the shares of trucks/truck travel which are for personal use (Table A.16).

**Passenger-miles** – Vehicle-miles multiplied by an average load factor.

**Load factor** – 2009 NHTS shows personal light truck load factor as 1.84 persons per vehicle (preliminary).

**Energy intensities** -

*Btu per vehicle-mile* – Personal light truck energy use divided by personal light truck vehicle-miles.

*Btu per passenger-mile* – Personal light truck energy use divided by personal light truck passenger-miles.

**Energy use** – See Energy Use Sources, p. A-9, A-10 (light trucks, medium/heavy trucks). Data by truck type were multiplied by the shares of truck fuel use which are for personal use (Table A.16) which were derived by ORNL from the 2002 VIUS Micro Data File on CD.

**Table A.16**  
**Share of Trucks, Truck Travel,**  
**and Fuel Use for Personal Travel**

|                                |  |  |
|--------------------------------|--|--|
| <b>Personal trucks</b>         |  |  |
| 85.6%                          | 2-axle, 4-tire trucks                    |  |
| 26.9%                          | Other single-unit and combination trucks |  |
| <b>Personal truck travel</b>   |  |  |
| 80.9%                          | 2-axle, 4-tire trucks                    |  |
| 13.1%                          | Other single-unit and combination trucks |  |
| <b>Personal truck fuel use</b> |  |  |
| 78.0%                          | 2-axle, 4-tire trucks                    |  |
| 6.0%                           | Other single-unit and combination trucks |  |

**Note:** Since these shares come from the 2002 VIUS, they may underestimate the amount of personal trucks, truck travel, and energy use for 2008.

## **Motorcycles**

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**Number of vehicles, vehicle-miles** – DOT, FHWA, *Highway Statistics 2009*, Table VM-1.

**Passenger-miles** – Vehicle-miles multiplied by an average load factor.

**Load factor** – 2009 NHTS shows motorcycle load factor as 1.16 persons per vehicle (preliminary).

**Energy intensities** –

*Btu per vehicle-mile* – Motorcycle energy use divided by vehicle-miles.

*Btu per passenger-mile* – Motorcycle energy use divided by passenger-miles.

**Energy use** – See Energy Use Sources, p. A-6. Data series shown in Table 2.7.

## **Demand Response**

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**Number of vehicles, vehicle-miles, passenger-miles** – APTA, *2011 Public Transportation Fact Book*, Washington, DC, 2011.

**Load factor** – Passenger-miles divided by vehicle-miles.

**Energy intensities** –

*Btu per vehicle-mile* – Energy use divided by vehicle-miles.

*Btu per passenger-mile* – Energy use divided by passenger-miles.

**Energy use** – APTA, *2011 Public Transportation Fact Book*, Washington, DC, 2011.

## **Buses**

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### **Transit**

**Number of vehicles, vehicle-miles, passenger-miles** – APTA, *2011 Public Transportation Fact Book*, Washington, DC, 2011. Data series shown on Table 5.16.

**Load factor** – Passenger-miles divided by vehicle-miles.

**Energy intensities** –

*Btu per vehicle-mile* – Transit bus energy use divided by transit bus vehicle-miles.

*Btu per passenger-mile* – Transit bus energy use divided by transit bus passenger-miles.

**Energy use** – See Energy Use Sources, p. A-7. Data series shown in Table 5.16.

## Intercity

**Energy use** – See Energy Use Sources, p. A-7. Because the 2001 and 2002 data are not available, the rate of change in bus VMT from FHWA, *Highway Statistics 2009*, was used to estimate the change in energy use.

## School

**Number of vehicles** – DOT, FHWA, *Highway Statistics 2009*, Table MV-10.

**Energy use** – See Energy Use Sources, p. A-7. Because the data past 2000 are not available, the rate of change in bus VMT from FHWA, *Highway Statistics 2009*, was used to estimate the change in energy use.

## Air

### Certificated air carriers

**Aircraft-miles, passenger-miles** – DOT, BTS, *Air Carrier Traffic Statistics*, [www.bts.gov/programs/airline\\_information/air\\_carrier\\_traffic\\_statistics](http://www.bts.gov/programs/airline_information/air_carrier_traffic_statistics), Washington, DC.

**Load factor** – Passenger-miles divided by aircraft-miles.

**Energy intensities** –

*Btu per passenger-mile* – Certificated air carrier energy use divided by passenger-miles.

**Energy use** – See Energy Use Sources, p. A-11. All of domestic fuel use and half of international fuel use was considered to be domestic use.

**Note:** These data differ from the data in Table 9.2 because that table contains data on ALL domestic AND international air carrier energy use and passenger-miles.

### General aviation

**Number of vehicles** – DOT, FAA, *General Aviation Activity and Avionics Survey: Calendar Year 2009*, Data series shown in Table 9.3.

**Energy intensities** –

*Btu per passenger-mile* – General aviation energy use divided by passenger-miles.

**Energy use** – See Energy Use Sources, p. A-11. Data series shown in Table 9.3.

## Recreational boating

*Number of vehicles and energy use* – U.S. EPA, NONROAD2008a model.

## **Rail**

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### **Intercity**

**Number of vehicles, vehicle-miles, passenger-miles** – AAR, *Railroad Facts, 2010 Edition*, Washington, DC, 2010.

**Load factor** – Passenger-miles divided by vehicle-miles.

**Energy Intensities** –

*Btu per vehicle-mile* – Intercity rail energy use divided by vehicle-miles.

*Btu per passenger-mile* – Intercity rail energy use divided by passenger-miles.

**Energy use** – See Energy Use Sources, p. A-20. Data series shown in Table 9.10.

### **Transit**

**Number of vehicles, vehicle-miles, passenger-miles** – APTA, *2011 Public Transportation Fact Book*, Washington, DC, 2011. Sum of light and heavy rail transit. Data series shown on Table 9.12.

**Load factor** – Passenger-miles divided by vehicle-miles.

**Energy intensities** –

*Btu per vehicle-mile* – Light and heavy transit rail energy use divided by vehicle-miles.

*Btu per passenger-mile* – Light and heavy transit rail energy use divided by passenger-miles.

**Energy use** – See Energy Use Sources, p. A-19. Data series shown in Table 9.12.

### **Commuter**

**Number of vehicles, vehicle-miles, passenger-miles** – APTA, *2011 Public Transportation Fact Book*, Washington, DC, 2011. Data series shown on Table 9.11.

**Load factor** – Passenger-miles divided by vehicle-miles.

**Energy intensities** –

*Btu per vehicle-mile* – Commuter rail energy use divided by vehicle-miles.

*Btu per passenger-mile* – Commuter rail energy use divided by passenger-miles.

**Energy use** – See Energy Use Sources, p. A-18. Data series shown in Table 9.11.

## Highway Passenger Mode Energy Intensities

### Automobiles

**Btu per vehicle-mile** – Automobile energy use divided by automobile vehicle miles of travel.

*Energy use* – See Energy Use Sources, p. A-5. Data series shown in Table 2.7.

*Vehicle-miles* – DOT, FHWA, *Highway Statistics 2009*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary to 1995*. Data series shown in Table 4.1.

**Btu per passenger-mile** – Automobile energy use divided by automobile passenger-miles.

*Energy use* – See Energy Use Sources, p. A-5. Data series shown in Table 2.7.

*Passenger miles* – Vehicle miles multiplied by an average load factor.

*Vehicle-miles* – DOT, FHWA, *Highway Statistics 2009*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary to 1995*. Data series shown in Table 4.1.

*Load factor* – NPTS 1969, 1977, 1983/84, 1990, and 1995; NHTS 2001 and 2009.

**Table A.17**  
**Automobile Load Factor used to calculate Passenger-Miles**

| Year | Source       | Load Factor |
|------|--------------|-------------|
| 1970 | 1969 NPTS    | 1.90        |
| 1971 | Interpolated | 1.90        |
| 1972 | Interpolated | 1.90        |
| 1973 | Interpolated | 1.90        |
| 1974 | Interpolated | 1.90        |
| 1975 | Interpolated | 1.90        |
| 1976 | Interpolated | 1.90        |
| 1977 | 1977 NPTS    | 1.90        |
| 1978 | Interpolated | 1.88        |
| 1979 | Interpolated | 1.87        |
| 1980 | Interpolated | 1.85        |
| 1981 | Interpolated | 1.83        |
| 1982 | Interpolated | 1.82        |
| 1983 | 1983/84 NPTS | 1.80        |
| 1984 | Interpolated | 1.77        |
| 1985 | Interpolated | 1.74        |
| 1986 | Interpolated | 1.71        |
| 1987 | Interpolated | 1.69        |
| 1988 | Interpolated | 1.66        |
| 1989 | Interpolated | 1.63        |
| 1990 | 1990 NPTS    | 1.60        |
| 1991 | Interpolated | 1.60        |
| 1992 | Interpolated | 1.60        |
| 1993 | Interpolated | 1.60        |
| 1994 | Interpolated | 1.60        |
| 1995 | 1995 NPTS    | 1.60        |
| 1996 | Interpolated | 1.60        |
| 1997 | Interpolated | 1.59        |
| 1998 | Interpolated | 1.59        |
| 1999 | Interpolated | 1.58        |
| 2000 | Interpolated | 1.58        |
| 2001 | 2001 NHTS    | 1.57        |
| 2002 | 2001 NHTS    | 1.57        |
| 2003 | 2001 NHTS    | 1.57        |
| 2004 | 2001 NHTS    | 1.57        |
| 2005 | 2001 NHTS    | 1.57        |
| 2006 | 2001 NHTS    | 1.57        |
| 2007 | 2001 NHTS    | 1.57        |
| 2008 | 2009 NHTS    | 1.55        |
| 2009 | 2009 NHTS    | 1.55        |

## **Light trucks**

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**Btu per vehicle-mile** – Light truck energy use divided by light truck vehicle miles of travel.

*Energy use* – See Energy Use Sources, p. A-9. Data series shown in Table 2.7.

*Vehicle-miles* – DOT, FHWA, *Highway Statistics 2009*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary to 1995*. Data series shown in Table 4.2.

## **Buses**

---

### **Transit**

**Btu per vehicle-mile** – Transit bus energy use divided by transit bus vehicle-miles.

*Energy use* – See Energy Use Sources, p. A-7. Data series shown in Table 5.16.

*Vehicle-miles* – APTA, *2011 Public Transportation Fact Book*, Washington, DC, 2011. Data series shown on Table 5.16.

**Btu per passenger-mile** – Transit bus energy use divided by transit bus passenger-miles.

*Energy use* – See Energy Use Sources, p. A-7. Data series shown in Table 5.16.

*Passenger-miles* – APTA, *2011 Public Transportation Fact Book*, Washington, DC, 2011. Data series shown on Table 5.16.

### **Intercity**

**Btu per passenger-mile** – Intercity bus energy use divided by intercity bus passenger-miles.

*Energy use* – See Energy Use Sources, p. A-8. Because the data past 2000 are not available, the rate of change in bus VMT from FHWA, *Highway Statistics 2009*, was used to estimate the change in energy use.

*Passenger-miles* – (Data past 2000 are not available.) Eno Foundation for Transportation, *Transportation in America 2001*, Nineteenth edition, Washington, DC.

## Nonhighway Mode Energy Intensities

### Air

#### Certificated air carriers

**Btu per passenger-mile** – Certificated air carrier energy use divided by passenger-miles.

**Energy use** – See Energy Use Sources, p. A-12. All of domestic fuel use and half of international fuel use was considered to be domestic use.

**Passenger-miles** – DOT, BTS, *Air Carrier Traffic Statistics*, Washington, DC, [www.bts.gov/programs/airline\\_information/air\\_carrier\\_traffic\\_statistics](http://www.bts.gov/programs/airline_information/air_carrier_traffic_statistics). Pre-1994 data are from various editions of the *FAA Statistical Handbook of Aviation* (no longer published). Scheduled service passenger-miles of domestic air carriers and half of international air carriers were used to coincide with fuel use.

**Note:** These data differ from the data in Table 9.2 because that table contains data on ALL domestic AND international air carrier energy use and passenger-miles.

#### General aviation

**Btu per passenger-mile** – General aviation energy use divided by passenger-miles.

**Energy use** – See Energy Use Sources, p. A-11. Data series shown in Table 9.3.

**Passenger-miles** – (Data past 2000 not available.) Eno Foundation for Transportation, *Transportation in America 2001*, Nineteenth edition, Washington, DC.

### Rail

#### Intercity

**Btu per passenger-mile** – Intercity rail energy use divided by passenger-miles.

**Energy use** – See Energy Use Sources, p. A-20. Data series shown in Table 9.10.

**Passenger-miles** – AAR, *Railroad Facts, 2010 Edition*, and previous annual editions.

#### Transit

**Btu per passenger-mile** – Transit rail energy use divided by passenger-miles.

**Energy use** – See Energy Use Sources, p. A-19. Data series shown in Table 9.12.

**Passenger-miles** – APTA, *2011 Public Transportation Fact Book*, Washington, DC, 2011. Data series shown on Table 9.12.

#### Commuter

**Btu per passenger-mile** – Commuter rail energy use divided by passenger-miles.

**Energy use** – See Energy Use Sources, p. A-18. Data series shown in Table 9.11.

**Passenger-miles** – APTA, *2011 Public Transportation Fact Book*, Washington, DC, 2011. Data series shown on Table 9.11.

## Freight Movement and Energy Use

### Rail

**Number of locomotives, ton-miles, tons shipped, average length of haul** – AAR, *Railroad Facts, 2010 Edition*, Washington, DC, 2010. Data series shown in Table 9.8.

**Energy intensity** – Class I rail energy use divided by freight car-miles.

**Energy use** – See Energy Use Sources, p. A-16. Data series shown in Table 9.8.

### Water

**Number of vehicles** – U.S. Department of the Army, Army Corps of Engineers, *Waterborne Transportation Lines of the United States, Calendar Year 2009, Volume 1—National Summaries*, New Orleans, LA, 2010.

**Ton-miles, tons shipped, average length of haul** – U.S. Department of the Army, Army Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 2009, Part 5: National Summaries*, New Orleans, LA, 2010. Data series shown in Table 9.5.

**Btu per ton-mile** – Domestic waterborne commerce energy use divided by ton-miles.

**Energy use** – See Energy Use Sources, p. A-13. Data series shown in Table 9.5.



## Freight Mode Energy Intensities

### Truck

**Btu per vehicle-mile** – Heavy single-unit and combination truck energy use divided by vehicle miles

*Energy use* – See Energy Use Sources (medium/heavy trucks), p. A-10.

*Vehicle-miles* – DOT, FHWA, *Highway Statistics 2009*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary to 1995*. Data series is the total of vehicle travel data on Tables 5.1 and 5.2.

### Rail

**Btu per freight car-mile** – Class I rail energy use divided by freight car-miles.

*Energy use* – See Energy Use Sources, p. A-17. Data series shown in Table 9.8.

*Freight car miles* – AAR, *Railroad Facts, 2010 Edition*, Washington, DC, 2010. Data series shown in Table 9.8.

**Btu per ton-mile** – Class I rail energy use divided by ton-miles.

*Energy use* – See Energy Use Sources, p. A-17. Data series shown in Table 9.8.

*Ton-miles* – AAR, *Railroad Facts, 2010 Edition*, Washington, DC, 2010. Data series shown in Table 9.8.

### Water

**Btu per ton-mile** – Domestic waterborne commerce energy use divided by ton-miles.

*Energy use* – See Energy Use Sources, p. A-13. Data series shown in Table 9.5.

*Ton-miles* – U.S. Department of the Army, Army Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 2009*, Part 5: National Summaries, New Orleans, LA, 2010. Data series shown in Table 9.5.



# **APPENDIX B**

## **CONVERSIONS**



## CONVERSIONS

### A Note about Heating Values

The heat content of a fuel is the quantity of energy released by burning a unit amount of that fuel. However, this value is not absolute and can vary according to several factors. For example, empirical formulae for determining the heating value of liquid fuels depend on the fuels' American Petroleum Institute (API) gravity. The API gravity varies depending on the percent by weight of the chemical constituents and impurities in the fuel, both of which are affected by the combination of raw materials used to produce the fuel and by the type of manufacturing process. Temperature and climatic conditions are also factors.

Because of these variations, the heating values in Table B.4 may differ from values in other publications. The figures in this report are representative or average values, not absolute ones. The gross (higher) heating values used here agree with those used by the Energy Information Administration (EIA).

Heating values fall into two categories, usually referred to as “higher” (or gross) and “lower” (or net). If the products of fuel combustion are cooled back to the initial fuel-air or fuel-oxidizer mixture temperature and the water formed during combustion is condensed, the energy released by the process is the higher (gross) heating value. If the products of combustion are cooled to the initial fuel-air temperature, but the water is considered to remain as a vapor, the energy released by the process is the lower (net) heating value. Usually the difference between the gross and net heating values for fuels used in transportation is around 5 to 8 percent; however, it is important to be consistent in their use.

**Table B.1**  
**Hydrogen Heat Content**

| 1 kilogram hydrogen = |                     |
|-----------------------|---------------------|
| Higher heating value  | Lower heating value |
| 134,200 Btu           | 113,400 Btu         |
| 39.3 kWhr             | 33.2 kWhr           |
| 141,600 kJ            | 119,600 kJ          |
| 33,800 kCal           | 28,560 kCal         |

**Table B.2**  
**Hydrogen Conversions**

|                       | Weight         |                   | Gas                             |   | Liquid           |               |
|-----------------------|----------------|-------------------|---------------------------------|---|------------------|---------------|
|                       | Pounds<br>(lb) | Kilograms<br>(kg) | Standard<br>cubic feet<br>(SCF) | Normal<br>cubic meter<br>(Nm <sup>3</sup> ) | Gallons<br>(gal) | Liters<br>(L) |
| 1 lb                  | 1.0            | 0.4536            | 192.00                          | 5.047                                       | 1.6928           | 6.408         |
| 1 kg                  | 2.205          | 1.0               | 423.3                           | 11.126                                      | 3.733            | 14.128        |
| 1 SCF gas             | 0.005209       | 0.002363          | 1.0                             | 0.02628                                     | 0.00882          | 0.0339        |
| 1 Nm <sup>3</sup> gas | 0.19815        | 0.08988           | 38.04                           | 1.0   | 0.3355           | 1.2699        |
| 1 gal liquid          | 0.5906         | 0.2679            | 113.41                          | 2.981                                       | 1.0              | 3.785         |
| 1 L liquid            | 0.15604        | 0.07078           | 29.99                           | 0.77881                                     | 0.2642           | 1.0           |

**Table B.3**  
**Pressure Conversions**

|                       | Weight         |                   | Gas                             |   | Liquid           |               |
|-----------------------|----------------|-------------------|---------------------------------|---|------------------|---------------|
|                       | Pounds<br>(lb) | Kilograms<br>(kg) | Standard<br>cubic feet<br>(SCF) | Normal<br>cubic meter<br>(Nm <sup>3</sup> ) | Gallons<br>(gal) | Liters<br>(L) |
| 1 lb                  | 1.0            | 0.4536            | 192.00                          | 5.047                                       | 1.6928           | 6.408         |
| 1 kg                  | 2.205          | 1.0               | 423.3                           | 11.126                                      | 3.733            | 14.128        |
| 1 SCF gas             | 0.005209       | 0.002363          | 1.0                             | 0.02628                                     | 0.00882          | 0.0339        |
| 1 Nm <sup>3</sup> gas | 0.19815        | 0.08988           | 38.04                           | 1.0   | 0.3355           | 1.2699        |
| 1 gal liquid          | 0.5906         | 0.2679            | 113.41                          | 2.981                                       | 1.0              | 3.785         |
| 1 L liquid            | 0.15604        | 0.07078           | 29.99                           | 0.77881                                     | 0.2642           | 1.0           |

**Table B.4**  
**Heat Content for Various Fuels**

|                               |   |
|-------------------------------|---|
| Conventional gasoline         | 125,000 Btu/gal (gross) = 115,400 Btu/gal (net) |
| E10                           | 120,900 Btu/gal (gross) = 112,400 Btu/gal (net) |
| E15                           | 119,000 Btu/gal (gross) = 109,400 Btu/gal (net) |
| Hydrogen                      | 134,200 Btu/kg (gross) = 113,400 Btu/kg (net)   |
| Diesel motor fuel             | 138,700 Btu/gal (gross) = 128,700 Btu/gal (net) |
| Biodiesel                     | 126,200 Btu/gal (gross) = 117,100 Btu/gal (net) |
| Methanol                      | 64,600 Btu/gal (gross) = 56,600 Btu/gal (net)   |
| Ethanol                       | 84,600 Btu/gal (gross) = 75,700 Btu/gal (net)   |
| E85                           | 90,700 Btu/gal (gross) = 81,600 Btu/gal (net)   |
| Aviation gasoline             | 120,200 Btu/gal (gross) = 112,000 Btu/gal (net) |
| Liquefied petroleum gas (LPG) | 91,300 Btu/gal (gross) = 83,500 Btu/gal (net)   |
| Butane                        | 103,000 Btu/gal (gross) = 93,000 Btu/gal (net)  |
| Jet fuel (naphtha)            | 127,500 Btu/gal (gross) = 118,700 Btu/gal (net) |
| Jet fuel (kerosene)           | 135,000 Btu/gal (gross) = 128,100 Btu/gal (net) |
| Lubricants                    | 144,400 Btu/gal (gross) = 130,900 Btu/gal (net) |
| Waxes                         | 131,800 Btu/gal (gross) = 120,200 Btu/gal (net) |
| Asphalt and road oil          | 158,000 Btu/gal (gross) = 157,700 Btu/gal (net) |
| Liquefied natural gas (LNG)   | 84,800 Btu/gal (gross) = 74,700 Btu/gal (net)   |
| Compressed natural gas (CNG)  | 22,500 Btu/gal (gross) = 20,300 Btu/gal (net)   |
| Crude petroleum               | 138,100 Btu/gal (gross) = 131,800 Btu/gal (net) |
| Fuel Oils                     |   |
| Residual                      | 149,700 Btu/gal (gross) = 138,400 Btu/gal (net) |
| Distillate                    | 138,700 Btu/gal (gross) = 131,800 Btu/gal (net) |
| Coal                          |   |
| Production average            | $20.192 \times 10^6$ Btu/short ton              |
| Consumption average           | $19.612 \times 10^6$ Btu/short ton              |

**Table B.5**  
**Fuel Equivalents**

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|   |   |
|---|---|
| 1 million bbl crude oil/day                 | = 0.365 billion bbl crude oil/year<br>= 2.117 quadrillion Btu/year<br>= 107.944 million short tons coal/year<br>= 97.927 million metric tons coal/year<br>= 2.067 trillion ft <sup>3</sup> natural gas/year<br>= 2,233 petajoules/year  |
| 1 billion bbl crude oil/year                | = 2.740 million bbl crude oil/day<br>= 5.800 quadrillion Btu/year<br>= 295.737 million short tons coal/year<br>= 268.293 million metric tons coal/year<br>= 5.644 trillion ft <sup>3</sup> natural gas/year<br>= 6,119 petajoules/year  |
| 1 quadrillion Btu/year                      | = 0.5219 gasoline gallon equivalents<br>= 0.472 million bbl crude oil/day<br>= 172.414 million bbl crude oil/year<br>= 50.989 million short tons coal/year<br>= 46.257 million metric tons coal/year<br>= 976.563 billion ft <sup>3</sup> natural gas/year<br>= 1,055 petajoules/year |
| 1 billion short tons coal/year              | = 0.907 billion metric tons coal/year<br>= 9.264 million bbl crude oil/day<br>= 3.381 billion bbl crude oil/year<br>= 19.612 quadrillion Btu/year<br>= 19.152 trillion ft <sup>3</sup> natural gas/year<br>= 20,691 petajoules/year   |
| 1 billion metric tons coal/year             | = 1.102 billion short tons coal/year<br>= 8.404 million bbl crude oil/day<br>= 3.068 billion bbl crude oil/year<br>= 17.792 quadrillion btu/year<br>= 17.375 trillion ft <sup>3</sup> natural gas/year<br>= 18,771 petajoules/year  |
| 1 trillion ft <sup>3</sup> natural gas/year | = 0.484 million bbl crude oil/day<br>= 0.177 billion bbl crude oil/year<br>= 1.024 quadrillion Btu/year<br>= 52.213 million short tons coal/year<br>= 47.368 million metric tons coal/year<br>= 1,080 petajoules/year   |
| 1 petajoule/year                            | = 447.741 bbl crude oil/day<br>= 163.425 thousand bbl crude oil/year<br>= 0.948 trillion Btu/year<br>= 48.331 thousand short tons coal/year<br>= 43.846 thousand metric tons coal/year<br>= 0.926 billion ft <sup>3</sup> natural gas/year  |

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**Table B.6**  
**Energy Unit Conversions**

|        |  |               |  |
|--------|--|---------------|--|
| 1 Btu  | = 778.2 ft-lb                          | 1 kWhr        | = 3412 Btu <sup>a</sup>                |
|        | = 107.6 kg-m                           |               | = 2.655 x 10 <sup>6</sup> ft-lb        |
|        | = 1055 J                               |               | = 3.671 x 10 <sup>5</sup> kg-m         |
|        | = 39.30 x 10 <sup>-5</sup> hp-h        |               | = 3.600 x 10 <sup>6</sup> J            |
|        | = 39.85 x 10 <sup>-5</sup> metric hp-h |               | = 1.341 hp-h                           |
|        | = 29.31 x 10 <sup>-5</sup> kWhr        |               | = 1.360 metric hp-h                    |
| 1 kg-m | = 92.95 x 10 <sup>-4</sup> Btu         | 1 Joule       | = 94.78 x 10 <sup>-5</sup> Btu         |
|        | = 7.233 ft-lb                          |               | = 0.7376 ft-lb                         |
|        | = 9.806 J                              |               | = 0.1020 kg-m                          |
|        | = 36.53 x 10 <sup>-7</sup> hp-h        |               | = 37.25 x 10 <sup>-8</sup> hp-h        |
|        | = 37.04 x 10 <sup>-7</sup> metric hp-h |               | = 37.77 x 10 <sup>-8</sup> metric hp-h |
|        | = 27.24 x 10 <sup>-7</sup> kWhr        |               | = 27.78 x 10 <sup>-8</sup> kWhr        |
| 1 hp-h | = 2544 Btu                             | 1 metric hp-h | = 2510 Btu                             |
|        | = 1.98 x 10 <sup>6</sup> ft-lb         |               | = 1.953 x 10 <sup>6</sup> ft-lb        |
|        | = 2.738 x 10 <sup>6</sup> kgm          |               | = 27.00 x 10 <sup>4</sup> kg-m         |
|        | = 2.685 x 10 <sup>6</sup> J            |               | = 2.648 x 10 <sup>6</sup> J            |
|        | = 1.014 metric hp-h                    |               | = 0.9863 hp-h                          |
|        | = 0.7475 kWhr                          |               | = 0.7355 kWhr                          |

<sup>a</sup>This figure does not take into account the fact that electricity generation and distribution efficiency is approximately 33%. If generation and distribution efficiency are taken into account, 1 kWhr = 10,339 Btu.

**Table B.7**  
**International Energy Conversions**

|                                     |                           |                         | Million<br>tonnes of oil<br>equivalent | Million<br>Btu          | Gigawatt-<br>hours       |
|-------------------------------------|---------------------------|-------------------------|--|-------------------------|--------------------------|
| To:                                 | Petajoules                | Giga-<br>calories       |  |                         |                          |
| From:                               | <i>multiply by:</i>       |                         |  |                         |                          |
| Petajoules                          | 1                         | 238.8 x 10 <sup>3</sup> | 2.388 x 10 <sup>-2</sup>               | 947.8 x 10 <sup>3</sup> | 277.8                    |
| Gigacalories                        | 4.1868 x 10 <sup>-6</sup> | 1                       | 10 <sup>-7</sup>                       | 3.968                   | 1.163 x 10 <sup>-3</sup> |
| Million tonnes<br>of oil equivalent | 41.868                    | 10 <sup>7</sup>         | 1                                      | 3.968 x 10 <sup>7</sup> | 11,630                   |
| Million Btu                         | 1.0551 x 10 <sup>-6</sup> | 0.252                   | 2.52 X 10 <sup>-8</sup>                | 1                       | 2.931 x 10 <sup>-4</sup> |
| Gigawatthours                       | 3.6 x 10 <sup>-3</sup>    | 860                     | 8.6 x 10 <sup>-5</sup>                 | 3412                    | 1                        |

**Table B.8**  
**Distance and Velocity Conversions**

|  |   |                             |      |   |                             |
|--|---|-----------------------------|------|---|-----------------------------|
| 1 in.  | = | $83.33 \times 10^{-3}$ ft   | 1 ft | = | 12.0 in.                    |
|  | = | $27.78 \times 10^{-3}$ yd   |      | = | 0.33 yd                     |
|  | = | $15.78 \times 10^{-6}$ mile |      | = | $189.4 \times 10^{-3}$ mile |
|  | = | $25.40 \times 10^{-3}$ m    |      | = | 0.3048 m                    |
|  | = | $0.2540 \times 10^{-6}$ km  |      | = | $0.3048 \times 10^{-3}$ km  |
| 1 mile   | = | 63360 in.                   | 1 km | = | 39370 in.                   |
|  | = | 5280 ft                     |      | = | 3281 ft                     |
|  | = | 1760 yd                     |      | = | 1093.6 yd                   |
|  | = | 1609 m                      |      | = | 0.6214 mile                 |
|  | = | 1.609 km                    |      | = | 1000 m                      |
| 1 ft/sec = 0.3048 m/s = 0.6818 mph = 1.0972 km/h |   |                             |      |   |                             |
| 1 m/sec = 3.281 ft/s = 2.237 mph = 3.600 km/h    |   |                             |      |   |                             |
| 1 km/h = 0.9114 ft/s = 0.2778 m/s = 0.6214 mph   |   |                             |      |   |                             |
| 1 mph = 1.467 ft/s = 0.4469 m/s = 1.609 km/h     |   |                             |      |   |                             |

**Table B.9**  
**Alternative Measures of Greenhouse Gases**

|  |   |  |
|--|---|--|
| 1 pound methane, measured in carbon units (CH <sub>4</sub> )           | = | 1.333 pounds methane, measured at full molecular weight (CH <sub>4</sub> )         |
| 1 pound carbon dioxide, measured in carbon units (CO <sub>2</sub> -C)  | = | 3.6667 pounds carbon dioxide, measured at full molecular weight (CO <sub>2</sub> ) |
| 1 pound carbon monoxide, measured in carbon units (CO-C)               | = | 2.333 pounds carbon monoxide, measured at full molecular weight (CO)               |
| 1 pound nitrous oxide, measured in nitrogen units (N <sub>2</sub> O-N) | = | 1.571 pounds nitrous oxide, measured at full molecular weight (N <sub>2</sub> O)   |

**Table B.10**  
**Volume and Flow Rate Conversions<sup>a</sup>**

|  |                               |         |   |
|--|-------------------------------|---------|---|
| 1 U.S. gal   | = 231 in. <sup>3</sup>        | 1 liter | = 61.02 in. <sup>3</sup>                    |
|  | = 0.1337 ft <sup>3</sup>      |         | = 3.531 x 10 <sup>-2</sup> ft <sup>3</sup>  |
|  | = 3.785 liters                |         | = 0.2624 U.S. gal                           |
|  | = 0.8321 imperial gal         |         | = 0.2200 imperial gal                       |
|  | = 0.0238 bbl                  |         | = 6.29 x 10 <sup>-3</sup> bbl               |
|  | = 0.003785 m <sup>3</sup>     |         | = 0.001 m <sup>3</sup>                      |
| A U.S. gallon of gasoline weighs 6.2 pounds          |                               |         |   |
| 1 imperial gal                                       | = 277.4 in. <sup>3</sup>      | 1 bbl   | = 9702 in. <sup>3</sup>                     |
|  | = 0.1606 ft <sup>3</sup>      |         | = 5.615 ft <sup>3</sup>                     |
|  | = 4.545 liters                |         | = 158.97 liters                             |
|  | = 1.201 U.S. gal              |         | = 42 U.S. gal                               |
|  | = 0.0286 bbl                  |         | = 34.97 imperial gal                        |
|  | = 0.004546 m <sup>3</sup>     |         | = 0.15897 m <sup>3</sup>                    |
| 1 U.S. gal/hr  | = 3.209 ft <sup>3</sup> /day  |         | = 1171 ft <sup>3</sup> /year                |
|  | = 90.84 liter/day             |         | = 33157 liter/year                          |
|  | = 19.97 imperial gal/day      |         | = 7289 imperial gal/year                    |
|  | = 0.5712 bbl/day              |         | = 207.92 bbl/year                           |
| For Imperial gallons, multiply above values by 1.201 |                               |         |   |
| 1 liter/hr   | = 0.8474 ft <sup>3</sup> /day |         | = 309.3 ft <sup>3</sup> /year               |
|  | = 6.298 U.S. gal/day          |         | = 2299 U.S. gal/year                        |
|  | = 5.28 imperial gal/day       |         | = 1927 imperial gal/year                    |
|  | = 0.1510 bbl/day              |         | = 55.10 bbl/year                            |
| 1 bbl/hr   | = 137.8 ft <sup>3</sup> /year |         | = 49187 ft <sup>3</sup> /year               |
|  | = 1008 U.S. gal/day           |         | = 3.679 x 10 <sup>5</sup> U.S. gal/year     |
|  | = 839.3 imperial gal/day      |         | = 3.063 x 10 <sup>5</sup> imperial gal/year |
|  | = 3815 liter/day              |         | = 1.393 x 10 <sup>6</sup> liter/day         |

<sup>a</sup>The conversions for flow rates are identical to those for volume measures, if the time units are identical.

**Table B.11**  
**Power Conversions**

| FROM                 | TO                    |                        |                       |               |                         |                        |
|----------------------|-----------------------|------------------------|-----------------------|---------------|-------------------------|------------------------|
|                      | Horsepower            | Kilowatts              | Metric horsepower     | Ft-lb per sec | Kilocalories per sec    | Btu per sec            |
| Horsepower           | 1                     | 0.7457                 | 1.014                 | 550           | 0.1781                  | 0.7068                 |
| Kilowatts            | 1.341                 | 1                      | 1.360                 | 737.6         | 0.239                   | 0.9478                 |
| Metric horsepower    | 0.9863                | 0.7355                 | 1                     | 542.5         | 0.1757                  | 0.6971                 |
| Ft-lb per sec        | $1.36 \times 10^{-3}$ | $1.356 \times 10^{-3}$ | $1.84 \times 10^{-3}$ | 1             | $0.3238 \times 10^{-3}$ | $1.285 \times 10^{-3}$ |
| Kilocalories per sec | 5.615                 | 4.184                  | 5.692                 | 3088          | 1                       | 3.968                  |
| Btu per sec          | 1.415                 | 1.055                  | 1.434                 | 778.2         | 0.2520                  | 1                      |

**Table B.12**  
**Mass Conversions**

| FROM       | TO    |          |                         |                         |                         |
|------------|-------|----------|-------------------------|-------------------------|-------------------------|
|            | Pound | Kilogram | Short ton               | Long ton                | Metric ton              |
| Pound      | 1     | 0.4536   | $5.0 \times 10^{-4}$    | $4.4643 \times 10^{-4}$ | $4.5362 \times 10^{-4}$ |
| Kilogram   | 2.205 | 1        | $1.1023 \times 10^{-3}$ | $9.8425 \times 10^{-4}$ | $1.0 \times 10^{-3}$    |
| Short ton  | 2,000 | 907.2    | 1                       | 0.8929                  | 0.9072                  |
| Long ton   | 2,240 | 1,106    | 1.12                    | 1                       | 1.016                   |
| Metric ton | 2,205 | 1,000    | 1.102                   | 0.9842                  | 1                       |

**Table B.13**  
**Fuel Efficiency Conversions**

| MPG     | Miles/liter | Kilometers/L      | L/100<br>kilometers | Grams of<br>CO <sub>2</sub><br>per mile <sup>a</sup> | Pounds of CO <sub>2</sub><br>per mile <sup>a</sup> |
|---------|-------------|-------------------|---------------------|--|--|
| 10      | 2.64        | 4.25              | 23.52               | 877.80   | 1.94   |
| 15      | 3.96        | 6.38              | 15.68               | 585.20   | 1.29   |
| 20      | 5.28        | 8.50              | 11.76               | 438.90   | 0.97   |
| 25      | 6.60        | 10.63             | 9.41                | 351.12   | 0.78   |
| 30      | 7.92        | 12.75             | 7.84                | 292.60   | 0.65   |
| 35      | 9.25        | 14.88             | 6.72                | 250.80   | 0.55   |
| 40      | 10.57       | 17.00             | 5.88                | 219.45   | 0.49   |
| 45      | 11.89       | 19.13             | 5.23                | 195.07   | 0.43   |
| 50      | 13.21       | 21.25             | 4.70                | 175.56   | 0.39   |
| 55      | 14.53       | 23.38             | 4.28                | 159.60   | 0.35   |
| 60      | 15.85       | 25.51             | 3.92                | 146.30   | 0.32   |
| 65      | 17.17       | 27.63             | 3.62                | 135.05   | 0.30   |
| 70      | 18.49       | 29.76             | 3.36                | 125.40   | 0.28   |
| 75      | 19.81       | 31.88             | 3.14                | 117.04   | 0.26   |
| 80      | 21.13       | 34.01             | 2.94                | 109.73   | 0.24   |
| 85      | 22.45       | 36.13             | 2.77                | 103.27   | 0.23   |
| 90      | 23.77       | 38.26             | 2.61                | 97.53  | 0.22   |
| 95      | 25.09       | 40.38             | 2.48                | 92.40  | 0.20   |
| 100     | 26.42       | 42.51             | 2.35                | 87.78  | 0.19   |
| 105     | 27.74       | 44.64             | 2.24                | 83.60  | 0.18   |
| 110     | 29.06       | 46.76             | 2.14                | 79.80  | 0.18   |
| 115     | 30.38       | 48.89             | 2.05                | 76.33  | 0.17   |
| 120     | 31.70       | 51.01             | 1.96                | 73.15  | 0.16   |
| 125     | 33.02       | 53.14             | 1.88                | 70.22  | 0.16   |
| 130     | 34.34       | 55.26             | 1.81                | 67.52  | 0.15   |
| 135     | 35.66       | 57.39             | 1.74                | 65.02  | 0.14   |
| 140     | 36.98       | 59.51             | 1.68                | 62.70  | 0.14   |
| 145     | 38.30       | 61.64             | 1.62                | 60.54  | 0.13   |
| 150     | 39.62       | 63.76             | 1.57                | 58.52  | 0.13   |
| Formula | MPG/3.785   | MPG/[3.785/1.609] | 235.24/MPG          | 8,778/MPG  | 19.4/MPG   |

<sup>a</sup> For gasoline-fueled vehicles.

**Table B.14**  
**SI Prefixes and Their Values**

|                                | Value      | Prefix | Symbol |
|--------------------------------|------------|--------|--------|
| One million million millionth  | $10^{-18}$ | atto   | a      |
| One thousand million millionth | $10^{-15}$ | femto  | f      |
| One million millionth          | $10^{-12}$ | pico   | p      |
| One thousand millionth         | $10^{-9}$  | nano   | n      |
| One millionth                  | $10^{-6}$  | micro  | $\mu$  |
| One thousandth                 | $10^{-3}$  | milli  | m      |
| One hundredth                  | $10^{-2}$  | centi  | c      |
| One tenth                      | $10^{-1}$  | deci   |        |
| One                            | $10^0$     |        |        |
| Ten                            | $10^1$     | deca   |        |
| One hundred                    | $10^2$     | hecto  |        |
| One thousand                   | $10^3$     | kilo   | k      |
| One million                    | $10^6$     | mega   | M      |
| One billion <sup>a</sup>       | $10^9$     | giga   | G      |
| One trillion <sup>a</sup>      | $10^{12}$  | tera   | T      |
| One quadrillion <sup>a</sup>   | $10^{15}$  | peta   | P      |
| One quintillion <sup>a</sup>   | $10^{18}$  | exa    | E      |

<sup>a</sup>Care should be exercised in the use of this nomenclature, especially in foreign correspondence, as it is either unknown or carries a different value in other countries. A "billion," for example, signifies a value of  $10^{12}$  in most other countries.

**Table B.15**  
**Metric Units and Abbreviations**

| Quantity                        | Unit name                 | Symbol           |
|---------------------------------|---------------------------|------------------|
| Energy                          | joule                     | J                |
| Specific energy                 | joule/kilogram            | J/kg             |
| Specific energy consumption     | joule/kilogram•kilometer  | J/(kg•km)        |
| Energy consumption              | joule/kilometer           | J/km             |
| Energy economy                  | kilometer/kilojoule       | km/kJ            |
| Power                           | kilowatt                  | kW               |
| Specific power                  | watt/kilogram             | W/kg             |
| Power density                   | watt/meter <sup>3</sup>   | W/m <sup>3</sup> |
| Speed                           | kilometer/hour            | km/h             |
| Acceleration                    | meter/second <sup>2</sup> | m/s <sup>2</sup> |
| Range (distance)                | kilometer                 | km               |
| Weight                          | kilogram                  | kg               |
| Torque                          | newton•meter              | N•m              |
| Volume                          | meter <sup>3</sup>        | m <sup>3</sup>   |
| Mass; payload                   | kilogram                  | kg               |
| Length; width                   | meter                     | m                |
| Brake specific fuel consumption | kilogram/joule            | kg/J             |
| Fuel economy (heat engine)      | liters/100 km             | L/100 km         |

**Table B.16**  
**Carbon Coefficients, 2002**  
(Million metric tons carbon per quadrillion Btu)

| Fuel Type                |       |
|--------------------------|-------|
| Coal                     |       |
| Coal (residential)       | 26.04 |
| Coal (commercial)        | 26.04 |
| Coal (industrial coking) | 25.63 |
| Coal (industrial other)  | 25.74 |
| Coal (electric utility)  | 25.98 |
| Natural gas              |       |
| Natural gas (pipeline)   | 14.47 |
| Natural gas (flared)     | 14.92 |
| Petroleum                |       |
| Asphalt and road oil     | 20.62 |
| Aviation gasoline        | 18.87 |
| Crude oil                | 20.30 |
| Distillate fuel          | 19.95 |
| Jet fuel                 | 19.33 |
| Kerosene                 | 19.72 |
| LPG                      | 16.99 |
| Lubricants               | 20.24 |
| Motor gasoline           | 19.34 |
| Petrochemical feed.      | 19.37 |
| Petroleum coke           | 27.85 |
| Residual fuel            | 21.49 |
| Waxes                    | 19.81 |

**Note:** All coefficients based on Higher Heating (Gross Calorific) Value and assume 100 percent combustion.

## **Conversion of Constant Dollar Values**

Many types of information in this data book are expressed in dollars. Generally, constant dollars are used—that is, dollars of a fixed value for a specific year, such as 1990 dollars. Converting current dollars to constant dollars, or converting constant dollars for one year to constant dollars for another year, requires conversion factors (Table B.17 and B.18). Table B.17 shows conversion factors for the Consumer Price Index inflation factors. Table B.18 shows conversion factors using the Gross National Product inflation factors.



**Table B.17**  
**Consumer Price Inflation (CPI) Index**

| <b>From:</b> | <b>1970</b> | <b>1971</b> | <b>1972</b> | <b>1973</b> | <b>1974</b> | <b>1975</b> | <b>1976</b> | <b>1977</b> | <b>1978</b> | <b>1979</b> |
|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>1970</b>  | 1.000       | 1.044       | 1.077       | 1.144       | 1.271       | 1.387       | 1.466       | 1.562       | 1.680       | 1.871       |
| <b>1971</b>  | 0.958       | 1.000       | 1.032       | 1.096       | 1.217       | 1.328       | 1.405       | 1.496       | 1.610       | 1.793       |
| <b>1972</b>  | 0.928       | 0.969       | 1.000       | 1.062       | 1.179       | 1.287       | 1.361       | 1.450       | 1.560       | 1.737       |
| <b>1973</b>  | 0.874       | 0.912       | 0.941       | 1.000       | 1.110       | 1.212       | 1.282       | 1.365       | 1.468       | 1.635       |
| <b>1974</b>  | 0.787       | 0.822       | 0.848       | 0.901       | 1.000       | 1.091       | 1.154       | 1.229       | 1.323       | 1.473       |
| <b>1975</b>  | 0.721       | 0.753       | 0.777       | 0.825       | 0.916       | 1.000       | 1.058       | 1.126       | 1.212       | 1.349       |
| <b>1976</b>  | 0.682       | 0.712       | 0.735       | 0.780       | 0.866       | 0.946       | 1.000       | 1.065       | 1.146       | 1.276       |
| <b>1977</b>  | 0.640       | 0.668       | 0.690       | 0.733       | 0.814       | 0.888       | 0.939       | 1.000       | 1.076       | 1.198       |
| <b>1978</b>  | 0.595       | 0.621       | 0.641       | 0.681       | 0.756       | 0.825       | 0.873       | 0.929       | 1.000       | 1.113       |
| <b>1979</b>  | 0.534       | 0.558       | 0.576       | 0.612       | 0.679       | 0.741       | 0.784       | 0.835       | 0.898       | 1.000       |
| <b>1980</b>  | 0.471       | 0.492       | 0.507       | 0.539       | 0.598       | 0.653       | 0.691       | 0.735       | 0.791       | 0.881       |
| <b>1981</b>  | 0.427       | 0.446       | 0.460       | 0.488       | 0.542       | 0.592       | 0.626       | 0.667       | 0.717       | 0.799       |
| <b>1982</b>  | 0.402       | 0.420       | 0.433       | 0.460       | 0.511       | 0.558       | 0.590       | 0.628       | 0.676       | 0.752       |
| <b>1983</b>  | 0.390       | 0.407       | 0.420       | 0.446       | 0.495       | 0.540       | 0.571       | 0.608       | 0.655       | 0.729       |
| <b>1984</b>  | 0.373       | 0.390       | 0.402       | 0.427       | 0.474       | 0.518       | 0.548       | 0.583       | 0.628       | 0.699       |
| <b>1985</b>  | 0.361       | 0.376       | 0.388       | 0.413       | 0.458       | 0.500       | 0.529       | 0.563       | 0.606       | 0.675       |
| <b>1986</b>  | 0.354       | 0.370       | 0.381       | 0.405       | 0.450       | 0.491       | 0.519       | 0.553       | 0.595       | 0.662       |
| <b>1987</b>  | 0.342       | 0.357       | 0.368       | 0.391       | 0.434       | 0.474       | 0.501       | 0.533       | 0.574       | 0.639       |
| <b>1988</b>  | 0.328       | 0.342       | 0.353       | 0.375       | 0.417       | 0.455       | 0.481       | 0.512       | 0.551       | 0.614       |
| <b>1989</b>  | 0.313       | 0.327       | 0.337       | 0.358       | 0.398       | 0.434       | 0.459       | 0.489       | 0.526       | 0.585       |
| <b>1990</b>  | 0.297       | 0.310       | 0.320       | 0.340       | 0.377       | 0.412       | 0.435       | 0.464       | 0.499       | 0.555       |
| <b>1991</b>  | 0.285       | 0.297       | 0.307       | 0.326       | 0.362       | 0.395       | 0.418       | 0.445       | 0.479       | 0.533       |
| <b>1992</b>  | 0.277       | 0.289       | 0.298       | 0.316       | 0.351       | 0.383       | 0.406       | 0.432       | 0.465       | 0.517       |
| <b>1993</b>  | 0.269       | 0.280       | 0.289       | 0.307       | 0.341       | 0.372       | 0.394       | 0.419       | 0.451       | 0.502       |
| <b>1994</b>  | 0.262       | 0.273       | 0.282       | 0.300       | 0.333       | 0.363       | 0.384       | 0.409       | 0.440       | 0.490       |
| <b>1995</b>  | 0.255       | 0.266       | 0.274       | 0.291       | 0.323       | 0.353       | 0.373       | 0.398       | 0.428       | 0.476       |
| <b>1996</b>  | 0.247       | 0.258       | 0.266       | 0.283       | 0.314       | 0.343       | 0.363       | 0.386       | 0.416       | 0.463       |
| <b>1997</b>  | 0.242       | 0.252       | 0.260       | 0.277       | 0.307       | 0.335       | 0.355       | 0.378       | 0.406       | 0.452       |
| <b>1998</b>  | 0.238       | 0.248       | 0.256       | 0.272       | 0.302       | 0.330       | 0.349       | 0.372       | 0.400       | 0.445       |
| <b>1999</b>  | 0.233       | 0.243       | 0.251       | 0.267       | 0.296       | 0.323       | 0.342       | 0.364       | 0.391       | 0.436       |
| <b>2000</b>  | 0.225       | 0.235       | 0.243       | 0.258       | 0.286       | 0.312       | 0.330       | 0.352       | 0.379       | 0.422       |
| <b>2001</b>  | 0.219       | 0.229       | 0.236       | 0.251       | 0.278       | 0.304       | 0.321       | 0.342       | 0.368       | 0.410       |
| <b>2002</b>  | 0.216       | 0.225       | 0.232       | 0.247       | 0.274       | 0.299       | 0.316       | 0.337       | 0.362       | 0.404       |
| <b>2003</b>  | 0.211       | 0.220       | 0.227       | 0.241       | 0.268       | 0.292       | 0.309       | 0.329       | 0.354       | 0.395       |
| <b>2004</b>  | 0.205       | 0.214       | 0.221       | 0.235       | 0.261       | 0.285       | 0.301       | 0.321       | 0.345       | 0.384       |
| <b>2005</b>  | 0.199       | 0.207       | 0.214       | 0.227       | 0.252       | 0.275       | 0.291       | 0.310       | 0.334       | 0.372       |
| <b>2006</b>  | 0.192       | 0.201       | 0.207       | 0.220       | 0.245       | 0.267       | 0.282       | 0.301       | 0.323       | 0.360       |
| <b>2007</b>  | 0.187       | 0.195       | 0.202       | 0.214       | 0.238       | 0.259       | 0.274       | 0.292       | 0.314       | 0.350       |
| <b>2008</b>  | 0.180       | 0.188       | 0.194       | 0.206       | 0.229       | 0.250       | 0.264       | 0.281       | 0.303       | 0.337       |
| <b>2009</b>  | 0.181       | 0.189       | 0.195       | 0.207       | 0.230       | 0.251       | 0.265       | 0.282       | 0.304       | 0.338       |
| <b>2010</b>  | 0.178       | 0.186       | 0.192       | 0.204       | 0.226       | 0.247       | 0.261       | 0.278       | 0.299       | 0.333       |

**Table B.17**  
**Consumer Price Inflation (CPI) Index (Continued)**

| <b>From:</b> | <b>1980</b> | <b>1981</b> | <b>1982</b> | <b>1983</b> | <b>1984</b> | <b>1985</b> | <b>1986</b> | <b>1987</b> | <b>1988</b> | <b>1989</b> |
|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>1970</b>  | 2.124       | 2.343       | 2.487       | 2.567       | 2.678       | 2.773       | 2.825       | 2.928       | 3.049       | 3.196       |
| <b>1971</b>  | 2.035       | 2.244       | 2.383       | 2.459       | 2.565       | 2.657       | 2.706       | 2.805       | 2.921       | 3.062       |
| <b>1972</b>  | 1.971       | 2.175       | 2.309       | 2.383       | 2.486       | 2.574       | 2.622       | 2.718       | 2.830       | 2.967       |
| <b>1973</b>  | 1.856       | 2.047       | 2.173       | 2.243       | 2.340       | 2.423       | 2.468       | 2.559       | 2.664       | 2.793       |
| <b>1974</b>  | 1.671       | 1.844       | 1.957       | 2.020       | 2.108       | 2.183       | 2.223       | 2.304       | 2.400       | 2.515       |
| <b>1975</b>  | 1.532       | 1.690       | 1.794       | 1.851       | 1.931       | 2.000       | 2.037       | 2.112       | 2.199       | 2.305       |
| <b>1976</b>  | 1.448       | 1.598       | 1.696       | 1.750       | 1.826       | 1.891       | 1.926       | 1.996       | 2.079       | 2.179       |
| <b>1977</b>  | 1.360       | 1.500       | 1.592       | 1.644       | 1.715       | 1.776       | 1.809       | 1.875       | 1.952       | 2.046       |
| <b>1978</b>  | 1.264       | 1.394       | 1.480       | 1.528       | 1.594       | 1.650       | 1.681       | 1.742       | 1.814       | 1.902       |
| <b>1979</b>  | 1.135       | 1.252       | 1.329       | 1.372       | 1.431       | 1.482       | 1.510       | 1.565       | 1.629       | 1.708       |
| <b>1980</b>  | 1.000       | 1.103       | 1.171       | 1.209       | 1.261       | 1.306       | 1.330       | 1.379       | 1.436       | 1.505       |
| <b>1981</b>  | 0.906       | 1.000       | 1.062       | 1.096       | 1.143       | 1.184       | 1.206       | 1.250       | 1.301       | 1.364       |
| <b>1982</b>  | 0.854       | 0.942       | 1.000       | 1.032       | 1.077       | 1.115       | 1.136       | 1.177       | 1.226       | 1.285       |
| <b>1983</b>  | 0.827       | 0.913       | 0.969       | 1.000       | 1.043       | 1.080       | 1.100       | 1.141       | 1.188       | 1.245       |
| <b>1984</b>  | 0.793       | 0.875       | 0.929       | 0.959       | 1.000       | 1.036       | 1.055       | 1.093       | 1.139       | 1.193       |
| <b>1985</b>  | 0.766       | 0.845       | 0.897       | 0.926       | 0.966       | 1.000       | 1.019       | 1.056       | 1.099       | 1.152       |
| <b>1986</b>  | 0.752       | 0.829       | 0.880       | 0.909       | 0.948       | 0.982       | 1.000       | 1.036       | 1.079       | 1.131       |
| <b>1987</b>  | 0.725       | 0.800       | 0.849       | 0.877       | 0.915       | 0.947       | 0.965       | 1.000       | 1.041       | 1.092       |
| <b>1988</b>  | 0.697       | 0.768       | 0.816       | 0.842       | 0.878       | 0.910       | 0.926       | 0.960       | 1.000       | 1.048       |
| <b>1989</b>  | 0.665       | 0.733       | 0.778       | 0.803       | 0.838       | 0.868       | 0.884       | 0.916       | 0.954       | 1.000       |
| <b>1990</b>  | 0.630       | 0.695       | 0.738       | 0.762       | 0.795       | 0.823       | 0.839       | 0.869       | 0.905       | 0.949       |
| <b>1991</b>  | 0.605       | 0.667       | 0.709       | 0.731       | 0.763       | 0.790       | 0.805       | 0.834       | 0.869       | 0.910       |
| <b>1992</b>  | 0.587       | 0.648       | 0.688       | 0.710       | 0.741       | 0.767       | 0.781       | 0.810       | 0.843       | 0.884       |
| <b>1993</b>  | 0.570       | 0.629       | 0.668       | 0.689       | 0.719       | 0.745       | 0.758       | 0.786       | 0.819       | 0.858       |
| <b>1994</b>  | 0.556       | 0.613       | 0.651       | 0.672       | 0.701       | 0.726       | 0.740       | 0.767       | 0.798       | 0.837       |
| <b>1995</b>  | 0.541       | 0.596       | 0.633       | 0.654       | 0.682       | 0.706       | 0.719       | 0.745       | 0.776       | 0.814       |
| <b>1996</b>  | 0.525       | 0.579       | 0.615       | 0.635       | 0.662       | 0.686       | 0.699       | 0.724       | 0.754       | 0.790       |
| <b>1997</b>  | 0.513       | 0.566       | 0.601       | 0.621       | 0.647       | 0.670       | 0.683       | 0.708       | 0.737       | 0.773       |
| <b>1998</b>  | 0.506       | 0.558       | 0.592       | 0.611       | 0.637       | 0.660       | 0.672       | 0.697       | 0.726       | 0.761       |
| <b>1999</b>  | 0.495       | 0.546       | 0.579       | 0.598       | 0.624       | 0.646       | 0.658       | 0.682       | 0.710       | 0.744       |
| <b>2000</b>  | 0.479       | 0.528       | 0.560       | 0.578       | 0.603       | 0.625       | 0.636       | 0.660       | 0.687       | 0.720       |
| <b>2001</b>  | 0.465       | 0.513       | 0.545       | 0.562       | 0.587       | 0.608       | 0.619       | 0.641       | 0.668       | 0.700       |
| <b>2002</b>  | 0.458       | 0.505       | 0.536       | 0.554       | 0.578       | 0.598       | 0.609       | 0.631       | 0.658       | 0.689       |
| <b>2003</b>  | 0.448       | 0.494       | 0.524       | 0.541       | 0.565       | 0.585       | 0.596       | 0.617       | 0.643       | 0.674       |
| <b>2004</b>  | 0.436       | 0.481       | 0.511       | 0.527       | 0.550       | 0.570       | 0.580       | 0.601       | 0.626       | 0.656       |
| <b>2005</b>  | 0.422       | 0.465       | 0.494       | 0.510       | 0.532       | 0.551       | 0.561       | 0.582       | 0.606       | 0.635       |
| <b>2006</b>  | 0.409       | 0.451       | 0.479       | 0.494       | 0.515       | 0.534       | 0.544       | 0.563       | 0.587       | 0.615       |
| <b>2007</b>  | 0.397       | 0.438       | 0.465       | 0.480       | 0.501       | 0.519       | 0.529       | 0.548       | 0.571       | 0.598       |
| <b>2008</b>  | 0.383       | 0.422       | 0.448       | 0.463       | 0.483       | 0.500       | 0.509       | 0.528       | 0.549       | 0.576       |
| <b>2009</b>  | 0.384       | 0.424       | 0.450       | 0.464       | 0.484       | 0.502       | 0.511       | 0.530       | 0.551       | 0.578       |
| <b>2010</b>  | 0.378       | 0.417       | 0.443       | 0.457       | 0.476       | 0.493       | 0.503       | 0.521       | 0.543       | 0.569       |

**Table B.17**  
**Consumer Price Inflation (CPI) Index (Continued)**

| <b>From:</b> | <b>1990</b> | <b>1991</b> | <b>1992</b> | <b>1993</b> | <b>1994</b> | <b>1995</b> | <b>1996</b> | <b>1997</b> | <b>1998</b> | <b>1999</b> |
|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>1970</b>  | 3.369       | 3.510       | 3.616       | 3.724       | 3.820       | 3.928       | 4.044       | 4.137       | 4.201       | 4.294       |
| <b>1971</b>  | 3.227       | 3.363       | 3.464       | 3.568       | 3.659       | 3.763       | 3.874       | 3.963       | 4.025       | 4.114       |
| <b>1972</b>  | 3.127       | 3.258       | 3.356       | 3.457       | 3.545       | 3.646       | 3.754       | 3.840       | 3.900       | 3.986       |
| <b>1973</b>  | 2.944       | 3.068       | 3.160       | 3.255       | 3.338       | 3.432       | 3.534       | 3.615       | 3.671       | 3.752       |
| <b>1974</b>  | 2.651       | 2.763       | 2.846       | 2.931       | 3.006       | 3.091       | 3.183       | 3.256       | 3.306       | 3.379       |
| <b>1975</b>  | 2.429       | 2.532       | 2.608       | 2.686       | 2.755       | 2.833       | 2.916       | 2.983       | 3.030       | 3.097       |
| <b>1976</b>  | 2.297       | 2.394       | 2.466       | 2.540       | 2.605       | 2.678       | 2.757       | 2.821       | 2.865       | 2.928       |
| <b>1977</b>  | 2.157       | 2.248       | 2.315       | 2.384       | 2.446       | 2.515       | 2.589       | 2.649       | 2.690       | 2.749       |
| <b>1978</b>  | 2.005       | 2.089       | 2.152       | 2.216       | 2.273       | 2.337       | 2.406       | 2.462       | 2.500       | 2.555       |
| <b>1979</b>  | 1.800       | 1.876       | 1.933       | 1.990       | 2.041       | 2.099       | 2.161       | 2.211       | 2.245       | 2.295       |
| <b>1980</b>  | 1.586       | 1.653       | 1.703       | 1.754       | 1.799       | 1.850       | 1.904       | 1.948       | 1.978       | 2.022       |
| <b>1981</b>  | 1.438       | 1.498       | 1.543       | 1.590       | 1.630       | 1.677       | 1.726       | 1.766       | 1.793       | 1.833       |
| <b>1982</b>  | 1.354       | 1.411       | 1.454       | 1.497       | 1.536       | 1.579       | 1.626       | 1.663       | 1.689       | 1.726       |
| <b>1983</b>  | 1.312       | 1.367       | 1.409       | 1.451       | 1.488       | 1.530       | 1.575       | 1.611       | 1.637       | 1.673       |
| <b>1984</b>  | 1.258       | 1.311       | 1.350       | 1.391       | 1.426       | 1.467       | 1.510       | 1.545       | 1.569       | 1.603       |
| <b>1985</b>  | 1.215       | 1.266       | 1.304       | 1.343       | 1.377       | 1.416       | 1.458       | 1.492       | 1.515       | 1.548       |
| <b>1986</b>  | 1.193       | 1.243       | 1.280       | 1.318       | 1.352       | 1.391       | 1.432       | 1.464       | 1.487       | 1.520       |
| <b>1987</b>  | 1.151       | 1.199       | 1.235       | 1.272       | 1.305       | 1.342       | 1.381       | 1.413       | 1.435       | 1.467       |
| <b>1988</b>  | 1.105       | 1.151       | 1.186       | 1.221       | 1.253       | 1.288       | 1.326       | 1.357       | 1.378       | 1.408       |
| <b>1989</b>  | 1.054       | 1.098       | 1.131       | 1.165       | 1.195       | 1.229       | 1.265       | 1.294       | 1.315       | 1.344       |
| <b>1990</b>  | 1.000       | 1.042       | 1.073       | 1.106       | 1.134       | 1.166       | 1.200       | 1.228       | 1.247       | 1.275       |
| <b>1991</b>  | 0.960       | 1.000       | 1.030       | 1.061       | 1.088       | 1.119       | 1.152       | 1.178       | 1.197       | 1.223       |
| <b>1992</b>  | 0.932       | 0.971       | 1.000       | 1.030       | 1.056       | 1.086       | 1.118       | 1.144       | 1.162       | 1.187       |
| <b>1993</b>  | 0.904       | 0.943       | 0.971       | 1.000       | 1.026       | 1.055       | 1.086       | 1.111       | 1.128       | 1.153       |
| <b>1994</b>  | 0.882       | 0.919       | 0.947       | 0.975       | 1.000       | 1.028       | 1.059       | 1.083       | 1.100       | 1.124       |
| <b>1995</b>  | 0.858       | 0.894       | 0.921       | 0.948       | 0.972       | 1.000       | 1.030       | 1.053       | 1.070       | 1.093       |
| <b>1996</b>  | 0.833       | 0.868       | 0.894       | 0.921       | 0.945       | 0.971       | 1.000       | 1.023       | 1.039       | 1.062       |
| <b>1997</b>  | 0.814       | 0.849       | 0.874       | 0.900       | 0.923       | 0.950       | 0.978       | 1.000       | 1.016       | 1.038       |
| <b>1998</b>  | 0.802       | 0.836       | 0.861       | 0.887       | 0.909       | 0.935       | 0.963       | 0.985       | 1.000       | 1.022       |
| <b>1999</b>  | 0.785       | 0.818       | 0.842       | 0.867       | 0.890       | 0.915       | 0.942       | 0.963       | 0.978       | 1.000       |
| <b>2000</b>  | 0.759       | 0.791       | 0.815       | 0.839       | 0.861       | 0.885       | 0.911       | 0.932       | 0.947       | 0.967       |
| <b>2001</b>  | 0.738       | 0.769       | 0.792       | 0.816       | 0.837       | 0.861       | 0.886       | 0.906       | 0.920       | 0.941       |
| <b>2002</b>  | 0.727       | 0.757       | 0.780       | 0.803       | 0.824       | 0.847       | 0.872       | 0.892       | 0.906       | 0.926       |
| <b>2003</b>  | 0.710       | 0.740       | 0.763       | 0.785       | 0.805       | 0.828       | 0.853       | 0.872       | 0.886       | 0.905       |
| <b>2004</b>  | 0.692       | 0.721       | 0.743       | 0.765       | 0.785       | 0.807       | 0.831       | 0.850       | 0.863       | 0.882       |
| <b>2005</b>  | 0.669       | 0.697       | 0.718       | 0.740       | 0.759       | 0.780       | 0.803       | 0.822       | 0.835       | 0.853       |
| <b>2006</b>  | 0.648       | 0.676       | 0.696       | 0.717       | 0.735       | 0.756       | 0.778       | 0.796       | 0.809       | 0.826       |
| <b>2007</b>  | 0.630       | 0.657       | 0.677       | 0.697       | 0.715       | 0.735       | 0.757       | 0.774       | 0.786       | 0.804       |
| <b>2008</b>  | 0.607       | 0.633       | 0.652       | 0.671       | 0.688       | 0.708       | 0.729       | 0.745       | 0.757       | 0.774       |
| <b>2009</b>  | 0.602       | 0.635       | 0.654       | 0.674       | 0.691       | 0.710       | 0.731       | 0.748       | 0.760       | 0.777       |
| <b>2010</b>  | 0.599       | 0.625       | 0.643       | 0.663       | 0.680       | 0.699       | 0.720       | 0.736       | 0.748       | 0.764       |

**Table B.17**  
**Consumer Price Inflation (CPI) Index (Continued)**

| <b>From:</b> | <b>2000</b> | <b>2001</b> | <b>2002</b> | <b>2003</b> | <b>2004</b> | <b>2005</b> | <b>2006</b> | <b>2007</b> | <b>2008</b> | <b>2009</b> | <b>2010</b> |
|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>1970</b>  | 4.438       | 4.564       | 4.637       | 4.742       | 4.869       | 5.034       | 5.196       | 5.344       | 5.549       | 5.529       | 5.620       |
| <b>1971</b>  | 4.252       | 4.373       | 4.442       | 4.543       | 4.664       | 4.822       | 4.978       | 5.120       | 5.316       | 5.297       | 5.384       |
| <b>1972</b>  | 4.120       | 4.237       | 4.304       | 4.402       | 4.519       | 4.672       | 4.823       | 4.960       | 5.151       | 5.132       | 5.217       |
| <b>1973</b>  | 3.878       | 3.989       | 4.052       | 4.144       | 4.255       | 4.399       | 4.541       | 4.670       | 4.849       | 4.832       | 4.911       |
| <b>1974</b>  | 3.493       | 3.592       | 3.649       | 3.732       | 3.832       | 3.961       | 4.089       | 4.206       | 4.367       | 4.352       | 4.423       |
| <b>1975</b>  | 3.201       | 3.292       | 3.344       | 3.420       | 3.511       | 3.630       | 3.747       | 3.854       | 4.002       | 3.988       | 4.053       |
| <b>1976</b>  | 3.026       | 3.112       | 3.162       | 3.234       | 3.320       | 3.432       | 3.543       | 3.644       | 3.784       | 3.770       | 3.832       |
| <b>1977</b>  | 2.842       | 2.922       | 2.969       | 3.036       | 3.117       | 3.223       | 3.327       | 3.421       | 3.553       | 3.540       | 3.598       |
| <b>1978</b>  | 2.641       | 2.716       | 2.759       | 2.822       | 2.897       | 2.995       | 3.092       | 3.180       | 3.302       | 3.290       | 3.344       |
| <b>1979</b>  | 2.372       | 2.439       | 2.478       | 2.534       | 2.602       | 2.690       | 2.777       | 2.856       | 2.966       | 2.955       | 3.004       |
| <b>1980</b>  | 2.090       | 2.149       | 2.183       | 2.233       | 2.292       | 2.370       | 2.447       | 2.516       | 2.613       | 2.604       | 2.646       |
| <b>1981</b>  | 1.894       | 1.948       | 1.979       | 2.024       | 2.078       | 2.149       | 2.218       | 2.281       | 2.369       | 2.360       | 2.399       |
| <b>1982</b>  | 1.784       | 1.835       | 1.864       | 1.907       | 1.958       | 2.024       | 2.089       | 2.149       | 2.231       | 2.223       | 2.260       |
| <b>1983</b>  | 1.729       | 1.778       | 1.806       | 1.847       | 1.897       | 1.961       | 2.024       | 2.082       | 2.162       | 2.154       | 2.189       |
| <b>1984</b>  | 1.657       | 1.705       | 1.731       | 1.771       | 1.818       | 1.880       | 1.940       | 1.996       | 2.072       | 2.065       | 2.099       |
| <b>1985</b>  | 1.600       | 1.646       | 1.672       | 1.710       | 1.756       | 1.815       | 1.874       | 1.927       | 2.001       | 1.994       | 2.027       |
| <b>1986</b>  | 1.571       | 1.616       | 1.641       | 1.679       | 1.724       | 1.782       | 1.839       | 1.892       | 1.964       | 1.957       | 1.990       |
| <b>1987</b>  | 1.516       | 1.559       | 1.584       | 1.620       | 1.663       | 1.719       | 1.775       | 1.825       | 1.895       | 1.889       | 1.920       |
| <b>1988</b>  | 1.456       | 1.497       | 1.521       | 1.555       | 1.597       | 1.651       | 1.704       | 1.753       | 1.820       | 1.813       | 1.843       |
| <b>1989</b>  | 1.389       | 1.428       | 1.451       | 1.484       | 1.523       | 1.575       | 1.626       | 1.672       | 1.736       | 1.730       | 1.759       |
| <b>1990</b>  | 1.318       | 1.355       | 1.376       | 1.408       | 1.445       | 1.494       | 1.542       | 1.586       | 1.647       | 1.641       | 1.668       |
| <b>1991</b>  | 1.264       | 1.300       | 1.321       | 1.351       | 1.387       | 1.434       | 1.480       | 1.522       | 1.581       | 1.575       | 1.601       |
| <b>1992</b>  | 1.227       | 1.262       | 1.282       | 1.311       | 1.346       | 1.392       | 1.437       | 1.478       | 1.535       | 1.529       | 1.554       |
| <b>1993</b>  | 1.192       | 1.226       | 1.245       | 1.273       | 1.307       | 1.352       | 1.395       | 1.435       | 1.490       | 1.485       | 1.509       |
| <b>1994</b>  | 1.162       | 1.195       | 1.214       | 1.242       | 1.275       | 1.318       | 1.360       | 1.399       | 1.453       | 1.448       | 1.471       |
| <b>1995</b>  | 1.130       | 1.162       | 1.180       | 1.207       | 1.240       | 1.281       | 1.323       | 1.360       | 1.413       | 1.408       | 1.431       |
| <b>1996</b>  | 1.098       | 1.129       | 1.147       | 1.173       | 1.204       | 1.245       | 1.285       | 1.321       | 1.372       | 1.367       | 1.390       |
| <b>1997</b>  | 1.073       | 1.103       | 1.121       | 1.146       | 1.177       | 1.217       | 1.256       | 1.292       | 1.341       | 1.337       | 1.359       |
| <b>1998</b>  | 1.056       | 1.087       | 1.104       | 1.129       | 1.159       | 1.198       | 1.237       | 1.272       | 1.321       | 1.316       | 1.338       |
| <b>1999</b>  | 1.034       | 1.063       | 1.080       | 1.104       | 1.134       | 1.172       | 1.210       | 1.245       | 1.292       | 1.288       | 1.309       |
| <b>2000</b>  | 1.000       | 1.028       | 1.045       | 1.069       | 1.097       | 1.134       | 1.171       | 1.204       | 1.250       | 1.246       | 1.266       |
| <b>2001</b>  | 0.972       | 1.000       | 1.016       | 1.039       | 1.067       | 1.103       | 1.138       | 1.171       | 1.216       | 1.211       | 1.231       |
| <b>2002</b>  | 0.957       | 0.984       | 1.000       | 1.023       | 1.050       | 1.086       | 1.121       | 1.153       | 1.197       | 1.193       | 1.212       |
| <b>2003</b>  | 0.936       | 0.963       | 0.978       | 1.000       | 1.027       | 1.061       | 1.096       | 1.127       | 1.170       | 1.166       | 1.185       |
| <b>2004</b>  | 0.912       | 0.938       | 0.952       | 0.974       | 1.000       | 1.034       | 1.067       | 1.098       | 1.140       | 1.136       | 1.154       |
| <b>2005</b>  | 0.882       | 0.907       | 0.921       | 0.942       | 0.967       | 1.000       | 1.032       | 1.062       | 1.102       | 1.098       | 1.117       |
| <b>2006</b>  | 0.854       | 0.878       | 0.892       | 0.913       | 0.937       | 0.969       | 1.000       | 1.028       | 1.068       | 1.064       | 1.082       |
| <b>2007</b>  | 0.831       | 0.854       | 0.868       | 0.887       | 0.911       | 0.942       | 0.972       | 1.000       | 1.038       | 1.035       | 1.052       |
| <b>2008</b>  | 0.800       | 0.823       | 0.836       | 0.855       | 0.877       | 0.907       | 0.936       | 0.963       | 1.000       | 0.996       | 1.013       |
| <b>2009</b>  | 0.803       | 0.825       | 0.839       | 0.858       | 0.881       | 0.910       | 0.940       | 0.966       | 1.004       | 1.000       | 1.016       |
| <b>2010</b>  | 0.790       | 0.812       | 0.825       | 0.844       | 0.866       | 0.896       | 0.925       | 0.951       | 0.987       | 0.984       | 1.000       |

**Source:**

U.S. Bureau of Labor Statistics.

**Table B.18**  
**Gross National Product Implicit Price Deflator**

| <b>From:</b> | <b>1970</b> | <b>1971</b> | <b>1972</b> | <b>1973</b> | <b>1974</b> | <b>1975</b> | <b>1976</b> | <b>1977</b> | <b>1978</b> | <b>1979</b> |
|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>1970</b>  | 1.000       | 1.050       | 1.096       | 1.157       | 1.261       | 1.380       | 1.460       | 1.553       | 1.662       | 1.800       |
| <b>1971</b>  | 0.952       | 1.000       | 1.043       | 1.102       | 1.201       | 1.315       | 1.391       | 1.479       | 1.583       | 1.714       |
| <b>1972</b>  | 0.913       | 0.958       | 1.000       | 1.056       | 1.151       | 1.260       | 1.333       | 1.418       | 1.517       | 1.643       |
| <b>1973</b>  | 0.864       | 0.908       | 0.947       | 1.000       | 1.090       | 1.193       | 1.262       | 1.342       | 1.437       | 1.556       |
| <b>1974</b>  | 0.793       | 0.833       | 0.869       | 0.917       | 1.000       | 1.094       | 1.158       | 1.231       | 1.318       | 1.427       |
| <b>1975</b>  | 0.724       | 0.761       | 0.794       | 0.838       | 0.914       | 1.000       | 1.058       | 1.125       | 1.204       | 1.304       |
| <b>1976</b>  | 0.685       | 0.719       | 0.750       | 0.792       | 0.864       | 0.945       | 1.000       | 1.064       | 1.138       | 1.233       |
| <b>1977</b>  | 0.644       | 0.676       | 0.705       | 0.745       | 0.812       | 0.889       | 0.940       | 1.000       | 1.070       | 1.159       |
| <b>1978</b>  | 0.602       | 0.632       | 0.659       | 0.696       | 0.759       | 0.830       | 0.878       | 0.934       | 1.000       | 1.083       |
| <b>1979</b>  | 0.555       | 0.583       | 0.609       | 0.643       | 0.701       | 0.767       | 0.811       | 0.863       | 0.923       | 1.000       |
| <b>1980</b>  | 0.509       | 0.535       | 0.558       | 0.589       | 0.642       | 0.703       | 0.744       | 0.791       | 0.847       | 0.917       |
| <b>1981</b>  | 0.466       | 0.489       | 0.510       | 0.539       | 0.587       | 0.643       | 0.680       | 0.723       | 0.774       | 0.838       |
| <b>1982</b>  | 0.439       | 0.461       | 0.481       | 0.508       | 0.553       | 0.606       | 0.641       | 0.682       | 0.729       | 0.790       |
| <b>1983</b>  | 0.422       | 0.443       | 0.462       | 0.488       | 0.532       | 0.583       | 0.616       | 0.656       | 0.702       | 0.760       |
| <b>1984</b>  | 0.407       | 0.427       | 0.446       | 0.471       | 0.513       | 0.562       | 0.594       | 0.632       | 0.676       | 0.732       |
| <b>1985</b>  | 0.395       | 0.415       | 0.433       | 0.457       | 0.498       | 0.545       | 0.576       | 0.613       | 0.656       | 0.711       |
| <b>1986</b>  | 0.386       | 0.406       | 0.423       | 0.447       | 0.487       | 0.533       | 0.564       | 0.600       | 0.642       | 0.695       |
| <b>1987</b>  | 0.376       | 0.395       | 0.412       | 0.435       | 0.747       | 0.519       | 0.549       | 0.584       | 0.625       | 0.677       |
| <b>1988</b>  | 0.364       | 0.382       | 0.398       | 0.421       | 0.459       | 0.502       | 0.531       | 0.565       | 0.604       | 0.654       |
| <b>1989</b>  | 0.350       | 0.368       | 0.384       | 0.405       | 0.442       | 0.483       | 0.511       | 0.544       | 0.582       | 0.631       |
| <b>1990</b>  | 0.337       | 0.354       | 0.369       | 0.390       | 0.425       | 0.465       | 0.492       | 0.524       | 0.561       | 0.607       |
| <b>1991</b>  | 0.326       | 0.342       | 0.357       | 0.377       | 0.411       | 0.450       | 0.476       | 0.506       | 0.542       | 0.587       |
| <b>1992</b>  | 0.319       | 0.334       | 0.349       | 0.369       | 0.402       | 0.440       | 0.465       | 0.495       | 0.530       | 0.573       |
| <b>1993</b>  | 0.311       | 0.327       | 0.341       | 0.360       | 0.393       | 0.430       | 0.455       | 0.483       | 0.517       | 0.560       |
| <b>1994</b>  | 0.305       | 0.320       | 0.334       | 0.353       | 0.384       | 0.421       | 0.445       | 0.473       | 0.507       | 0.549       |
| <b>1995</b>  | 0.299       | 0.314       | 0.327       | 0.346       | 0.377       | 0.412       | 0.436       | 0.464       | 0.497       | 0.538       |
| <b>1996</b>  | 0.293       | 0.308       | 0.321       | 0.339       | 0.370       | 0.405       | 0.428       | 0.455       | 0.487       | 0.528       |
| <b>1997</b>  | 0.288       | 0.303       | 0.316       | 0.334       | 0.364       | 0.398       | 0.421       | 0.448       | 0.479       | 0.519       |
| <b>1998</b>  | 0.285       | 0.299       | 0.312       | 0.330       | 0.360       | 0.394       | 0.416       | 0.443       | 0.474       | 0.513       |
| <b>1999</b>  | 0.281       | 0.295       | 0.308       | 0.325       | 0.355       | 0.388       | 0.410       | 0.437       | 0.467       | 0.506       |
| <b>2000</b>  | 0.275       | 0.289       | 0.301       | 0.318       | 0.347       | 0.380       | 0.402       | 0.427       | 0.457       | 0.495       |
| <b>2001</b>  | 0.269       | 0.282       | 0.294       | 0.311       | 0.339       | 0.371       | 0.392       | 0.417       | 0.447       | 0.484       |
| <b>2002</b>  | 0.264       | 0.277       | 0.289       | 0.306       | 0.333       | 0.365       | 0.386       | 0.410       | 0.439       | 0.475       |
| <b>2003</b>  | 0.259       | 0.272       | 0.283       | 0.299       | 0.326       | 0.357       | 0.378       | 0.402       | 0.430       | 0.465       |
| <b>2004</b>  | 0.251       | 0.264       | 0.276       | 0.291       | 0.317       | 0.347       | 0.367       | 0.391       | 0.418       | 0.453       |
| <b>2005</b>  | 0.244       | 0.256       | 0.267       | 0.282       | 0.308       | 0.337       | 0.356       | 0.379       | 0.406       | 0.439       |
| <b>2006</b>  | 0.236       | 0.248       | 0.259       | 0.273       | 0.298       | 0.326       | 0.345       | 0.367       | 0.392       | 0.425       |
| <b>2007</b>  | 0.230       | 0.241       | 0.252       | 0.266       | 0.290       | 0.317       | 0.335       | 0.357       | 0.382       | 0.413       |
| <b>2008</b>  | 0.225       | 0.236       | 0.246       | 0.260       | 0.283       | 0.310       | 0.328       | 0.349       | 0.374       | 0.405       |
| <b>2009</b>  | 0.221       | 0.232       | 0.242       | 0.256       | 0.279       | 0.306       | 0.323       | 0.344       | 0.368       | 0.399       |
| <b>2010</b>  | 0.220       | 0.231       | 0.241       | 0.254       | 0.277       | 0.303       | 0.321       | 0.341       | 0.365       | 0.395       |

**Table B.18**  
**Gross National Product Implicit Price Deflator (Continued)**

| <b>From:</b> | <b>1980</b> | <b>1981</b> | <b>1982</b> | <b>1983</b> | <b>1984</b> | <b>1985</b> | <b>1986</b> | <b>1987</b> | <b>1988</b> | <b>1989</b> |
|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>1970</b>  | 1.963       | 2.148       | 2.279       | 2.369       | 2.458       | 2.533       | 2.589       | 2.660       | 2.751       | 2.855       |
| <b>1971</b>  | 1.870       | 2.046       | 2.170       | 2.256       | 2.341       | 2.413       | 2.466       | 2.533       | 2.620       | 2.719       |
| <b>1972</b>  | 1.792       | 1.960       | 2.080       | 2.162       | 2.244       | 2.312       | 2.363       | 2.428       | 2.510       | 2.606       |
| <b>1973</b>  | 1.697       | 1.857       | 1.970       | 2.048       | 2.125       | 2.190       | 2.238       | 2.299       | 2.378       | 2.468       |
| <b>1974</b>  | 1.557       | 1.703       | 1.807       | 1.879       | 1.949       | 2.009       | 2.053       | 2.109       | 2.181       | 2.264       |
| <b>1975</b>  | 1.422       | 1.556       | 1.651       | 1.716       | 1.781       | 1.835       | 1.876       | 1.927       | 1.993       | 2.068       |
| <b>1976</b>  | 1.344       | 1.471       | 1.561       | 1.623       | 1.683       | 1.735       | 1.773       | 1.822       | 1.884       | 1.955       |
| <b>1977</b>  | 1.264       | 1.383       | 1.467       | 1.525       | 1.583       | 1.631       | 1.667       | 1.713       | 1.771       | 1.838       |
| <b>1978</b>  | 1.181       | 1.292       | 1.371       | 1.425       | 1.479       | 1.524       | 1.557       | 1.600       | 1.655       | 1.717       |
| <b>1979</b>  | 1.091       | 1.193       | 1.266       | 1.316       | 1.366       | 1.407       | 1.438       | 1.478       | 1.528       | 1.586       |
| <b>1980</b>  | 1.000       | 1.094       | 1.161       | 1.207       | 1.252       | 1.290       | 1.319       | 1.355       | 1.401       | 1.454       |
| <b>1981</b>  | 0.914       | 1.000       | 1.061       | 1.103       | 1.144       | 1.179       | 1.205       | 1.238       | 1.281       | 1.329       |
| <b>1982</b>  | 0.861       | 0.943       | 1.000       | 1.040       | 1.079       | 1.112       | 1.136       | 1.167       | 1.207       | 1.253       |
| <b>1983</b>  | 0.829       | 0.907       | 0.962       | 1.000       | 1.038       | 1.069       | 1.093       | 1.123       | 1.161       | 1.205       |
| <b>1984</b>  | 0.799       | 0.874       | 0.927       | 0.964       | 1.000       | 1.031       | 1.053       | 1.082       | 1.119       | 1.161       |
| <b>1985</b>  | 0.775       | 0.848       | 0.900       | 0.935       | 0.970       | 1.000       | 1.022       | 1.050       | 1.086       | 1.127       |
| <b>1986</b>  | 0.758       | 0.830       | 0.880       | 0.915       | 0.950       | 0.978       | 1.000       | 1.027       | 1.063       | 1.103       |
| <b>1987</b>  | 0.738       | 0.808       | 0.857       | 0.891       | 0.924       | 0.952       | 0.973       | 1.000       | 1.034       | 1.073       |
| <b>1988</b>  | 0.714       | 0.781       | 0.828       | 0.861       | 0.894       | 0.921       | 0.941       | 0.967       | 1.000       | 1.038       |
| <b>1989</b>  | 0.688       | 0.752       | 0.798       | 0.830       | 0.861       | 0.887       | 0.907       | 0.932       | 0.963       | 1.000       |
| <b>1990</b>  | 0.662       | 0.724       | 0.768       | 0.799       | 0.829       | 0.854       | 0.873       | 0.897       | 0.928       | 0.963       |
| <b>1991</b>  | 0.640       | 0.700       | 0.743       | 0.772       | 0.801       | 0.825       | 0.844       | 0.867       | 0.896       | 0.930       |
| <b>1992</b>  | 0.625       | 0.684       | 0.726       | 0.755       | 0.783       | 0.807       | 0.825       | 0.847       | 0.876       | 0.909       |
| <b>1993</b>  | 0.611       | 0.669       | 0.709       | 0.738       | 0.765       | 0.789       | 0.806       | 0.828       | 0.856       | 0.889       |
| <b>1994</b>  | 0.598       | 0.655       | 0.695       | 0.722       | 0.749       | 0.772       | 0.789       | 0.811       | 0.838       | 0.870       |
| <b>1995</b>  | 0.586       | 0.642       | 0.681       | 0.708       | 0.734       | 0.757       | 0.773       | 0.794       | 0.822       | 0.853       |
| <b>1996</b>  | 0.575       | 0.630       | 0.668       | 0.694       | 0.721       | 0.743       | 0.759       | 0.780       | 0.806       | 0.837       |
| <b>1997</b>  | 0.566       | 0.619       | 0.657       | 0.683       | 0.709       | 0.730       | 0.746       | 0.767       | 0.793       | 0.823       |
| <b>1998</b>  | 0.560       | 0.613       | 0.650       | 0.676       | 0.701       | 0.722       | 0.738       | 0.759       | 0.784       | 0.814       |
| <b>1999</b>  | 0.552       | 0.604       | 0.641       | 0.666       | 0.691       | 0.712       | 0.728       | 0.748       | 0.773       | 0.803       |
| <b>2000</b>  | 0.540       | 0.591       | 0.627       | 0.652       | 0.676       | 0.697       | 0.712       | 0.732       | 0.757       | 0.785       |
| <b>2001</b>  | 0.528       | 0.577       | 0.612       | 0.637       | 0.660       | 0.681       | 0.696       | 0.715       | 0.739       | 0.767       |
| <b>2002</b>  | 0.518       | 0.567       | 0.602       | 0.626       | 0.649       | 0.669       | 0.684       | 0.702       | 0.726       | 0.754       |
| <b>2003</b>  | 0.508       | 0.555       | 0.589       | 0.613       | 0.636       | 0.655       | 0.669       | 0.688       | 0.711       | 0.738       |
| <b>2004</b>  | 0.494       | 0.540       | 0.573       | 0.596       | 0.618       | 0.637       | 0.651       | 0.669       | 0.692       | 0.718       |
| <b>2005</b>  | 0.479       | 0.524       | 0.556       | 0.578       | 0.600       | 0.618       | 0.632       | 0.649       | 0.671       | 0.697       |
| <b>2006</b>  | 0.463       | 0.507       | 0.538       | 0.559       | 0.580       | 0.598       | 0.611       | 0.628       | 0.649       | 0.674       |
| <b>2007</b>  | 0.451       | 0.493       | 0.523       | 0.544       | 0.564       | 0.582       | 0.594       | 0.611       | 0.632       | 0.656       |
| <b>2008</b>  | 0.441       | 0.483       | 0.512       | 0.533       | 0.533       | 0.569       | 0.582       | 0.598       | 0.618       | 0.642       |
| <b>2009</b>  | 0.435       | 0.476       | 0.505       | 0.525       | 0.544       | 0.561       | 0.573       | 0.590       | 0.610       | 0.633       |
| <b>2010</b>  | 0.431       | 0.472       | 0.501       | 0.520       | 0.540       | 0.556       | 0.569       | 0.585       | 0.605       | 0.628       |

**Table B.18**  
**Gross National Product Implicit Price Deflator (Continued)**

| <b>From:</b> | <b>1990</b> | <b>1991</b> | <b>1992</b> | <b>1993</b> | <b>1994</b> | <b>1995</b> | <b>1996</b> | <b>1997</b> | <b>1998</b> | <b>1999</b> |
|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>1970</b>  | 2.966       | 3.069       | 3.140       | 3.212       | 3.281       | 3.348       | 3.412       | 3.468       | 3.507       | 3.557       |
| <b>1971</b>  | 2.824       | 2.923       | 2.990       | 3.059       | 3.124       | 3.189       | 3.249       | 3.303       | 3.340       | 3.388       |
| <b>1972</b>  | 2.707       | 2.801       | 2.865       | 2.932       | 2.994       | 3.056       | 3.114       | 3.165       | 3.200       | 3.247       |
| <b>1973</b>  | 2.563       | 2.653       | 2.714       | 2.777       | 2.836       | 2.894       | 2.949       | 2.998       | 3.031       | 3.075       |
| <b>1974</b>  | 2.351       | 2.433       | 2.489       | 2.547       | 2.601       | 2.655       | 2.705       | 2.750       | 2.780       | 2.821       |
| <b>1975</b>  | 2.148       | 2.224       | 2.274       | 2.327       | 2.377       | 2.426       | 2.472       | 2.513       | 2.540       | 2.577       |
| <b>1976</b>  | 2.031       | 2.102       | 2.150       | 2.200       | 2.247       | 2.293       | 2.336       | 2.375       | 2.401       | 2.436       |
| <b>1977</b>  | 1.909       | 1.976       | 2.021       | 2.068       | 2.112       | 2.156       | 2.197       | 2.233       | 2.258       | 2.290       |
| <b>1978</b>  | 1.784       | 1.846       | 1.889       | 1.932       | 1.974       | 2.014       | 2.052       | 2.086       | 2.109       | 2.140       |
| <b>1979</b>  | 1.647       | 1.705       | 1.744       | 1.785       | 1.822       | 1.860       | 1.895       | 1.927       | 1.948       | 1.976       |
| <b>1980</b>  | 1.510       | 1.563       | 1.599       | 1.636       | 1.671       | 1.705       | 1.738       | 1.767       | 1.786       | 1.812       |
| <b>1981</b>  | 1.381       | 1.429       | 1.462       | 1.496       | 1.527       | 1.559       | 1.588       | 1.615       | 1.633       | 1.656       |
| <b>1982</b>  | 1.301       | 1.347       | 1.378       | 1.410       | 1.440       | 1.469       | 1.497       | 1.522       | 1.539       | 1.561       |
| <b>1983</b>  | 1.252       | 1.295       | 1.325       | 1.356       | 1.385       | 1.413       | 1.440       | 1.464       | 1.480       | 1.501       |
| <b>1984</b>  | 1.206       | 1.249       | 1.277       | 1.307       | 1.335       | 1.362       | 1.388       | 1.411       | 1.426       | 1.447       |
| <b>1985</b>  | 1.171       | 1.212       | 1.239       | 1.268       | 1.295       | 1.322       | 1.347       | 1.369       | 1.384       | 1.404       |
| <b>1986</b>  | 1.145       | 1.186       | 1.213       | 1.241       | 1.267       | 1.293       | 1.318       | 1.340       | 1.354       | 1.374       |
| <b>1987</b>  | 1.115       | 1.154       | 1.180       | 1.208       | 1.233       | 1.259       | 1.283       | 1.304       | 1.318       | 1.337       |
| <b>1988</b>  | 1.078       | 1.116       | 1.141       | 1.168       | 1.193       | 1.217       | 1.240       | 1.261       | 1.275       | 1.293       |
| <b>1989</b>  | 1.039       | 1.075       | 1.100       | 1.125       | 1.149       | 1.173       | 1.195       | 1.215       | 1.228       | 1.246       |
| <b>1990</b>  | 1.000       | 1.035       | 1.059       | 1.083       | 1.106       | 1.129       | 1.150       | 1.170       | 1.182       | 1.200       |
| <b>1991</b>  | 0.966       | 1.000       | 1.023       | 1.047       | 1.069       | 1.091       | 1.112       | 1.130       | 1.143       | 1.159       |
| <b>1992</b>  | 0.945       | 0.978       | 1.000       | 1.023       | 1.045       | 1.066       | 1.087       | 1.105       | 1.117       | 1.133       |
| <b>1993</b>  | 0.923       | 0.955       | 0.977       | 1.000       | 1.021       | 1.042       | 1.062       | 1.080       | 1.092       | 1.107       |
| <b>1994</b>  | 0.904       | 0.935       | 0.957       | 0.979       | 1.000       | 1.021       | 1.040       | 1.057       | 1.069       | 1.084       |
| <b>1995</b>  | 0.886       | 0.917       | 0.938       | 0.959       | 0.980       | 1.000       | 1.019       | 1.036       | 1.047       | 1.062       |
| <b>1996</b>  | 0.869       | 0.900       | 0.920       | 0.942       | 0.962       | 0.981       | 1.000       | 1.017       | 1.028       | 1.043       |
| <b>1997</b>  | 0.855       | 0.885       | 0.905       | 0.926       | 0.946       | 0.965       | 0.984       | 1.000       | 1.011       | 1.026       |
| <b>1998</b>  | 0.846       | 0.875       | 0.895       | 0.916       | 0.936       | 0.955       | 0.973       | 0.989       | 1.000       | 1.014       |
| <b>1999</b>  | 0.834       | 0.863       | 0.883       | 0.903       | 0.922       | 0.941       | 0.959       | 0.975       | 0.986       | 1.000       |
| <b>2000</b>  | 0.816       | 0.844       | 0.864       | 0.884       | 0.903       | 0.921       | 0.939       | 0.954       | 0.965       | 0.979       |
| <b>2001</b>  | 0.797       | 0.825       | 0.844       | 0.863       | 0.882       | 0.900       | 0.917       | 0.932       | 0.942       | 0.956       |
| <b>2002</b>  | 0.783       | 0.811       | 0.829       | 0.848       | 0.866       | 0.884       | 0.901       | 0.916       | 0.926       | 0.939       |
| <b>2003</b>  | 0.767       | 0.794       | 0.812       | 0.831       | 0.848       | 0.866       | 0.882       | 0.897       | 0.907       | 0.920       |
| <b>2004</b>  | 0.746       | 0.772       | 0.789       | 0.808       | 0.825       | 0.842       | 0.858       | 0.872       | 0.882       | 0.894       |
| <b>2005</b>  | 0.724       | 0.749       | 0.766       | 0.784       | 0.801       | 0.817       | 0.833       | 0.846       | 0.856       | 0.868       |
| <b>2006</b>  | 0.700       | 0.724       | 0.741       | 0.758       | 0.774       | 0.790       | 0.805       | 0.819       | 0.828       | 0.840       |
| <b>2007</b>  | 0.681       | 0.705       | 0.721       | 0.738       | 0.753       | 0.769       | 0.783       | 0.796       | 0.805       | 0.817       |
| <b>2008</b>  | 0.667       | 0.690       | 0.706       | 0.722       | 0.737       | 0.753       | 0.767       | 0.780       | 0.788       | 0.800       |
| <b>2009</b>  | 0.658       | 0.681       | 0.697       | 0.713       | 0.728       | 0.743       | 0.757       | 0.770       | 0.779       | 0.790       |
| <b>2010</b>  | 0.652       | 0.676       | 0.692       | 0.707       | 0.722       | 0.737       | 0.751       | 0.764       | 0.773       | 0.784       |

**Table B.18**  
**Gross National Product Implicit Price Deflator (Continued)**

| <b>From:</b> | <b>2000</b> | <b>2001</b> | <b>2002</b> | <b>2003</b> | <b>2004</b> | <b>2005</b> | <b>2006</b> | <b>2007</b> | <b>2008</b> | <b>2009</b> | <b>2010</b> |
|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>1970</b>  | 3.635       | 3.722       | 3.787       | 3.867       | 3.977       | 4.097       | 4.237       | 4.355       | 4.449       | 4.517       | 4.554       |
| <b>1971</b>  | 3.462       | 3.544       | 3.606       | 3.683       | 3.787       | 3.902       | 4.035       | 4.147       | 4.237       | 4.302       | 4.337       |
| <b>1972</b>  | 3.317       | 3.397       | 3.456       | 3.529       | 3.630       | 3.739       | 3.867       | 3.975       | 4.061       | 4.124       | 4.157       |
| <b>1973</b>  | 3.142       | 3.217       | 3.273       | 3.343       | 3.438       | 3.542       | 3.662       | 3.764       | 3.846       | 3.907       | 3.938       |
| <b>1974</b>  | 2.882       | 2.951       | 3.002       | 3.066       | 3.153       | 3.249       | 3.359       | 3.453       | 3.528       | 3.582       | 3.611       |
| <b>1975</b>  | 2.633       | 2.696       | 2.743       | 2.802       | 2.881       | 2.968       | 3.069       | 3.155       | 3.223       | 3.273       | 3.299       |
| <b>1976</b>  | 2.489       | 2.549       | 2.593       | 2.648       | 2.723       | 2.806       | 2.901       | 2.982       | 3.047       | 3.094       | 3.119       |
| <b>1977</b>  | 2.340       | 2.396       | 2.438       | 2.490       | 2.561       | 2.638       | 2.728       | 2.804       | 2.865       | 2.909       | 2.932       |
| <b>1978</b>  | 2.186       | 2.239       | 2.278       | 2.326       | 2.392       | 2.465       | 2.548       | 2.620       | 2.676       | 2.718       | 2.740       |
| <b>1979</b>  | 2.019       | 2.067       | 2.103       | 2.148       | 2.209       | 2.276       | 2.353       | 2.419       | 2.472       | 2.509       | 2.530       |
| <b>1980</b>  | 1.851       | 1.896       | 1.929       | 1.970       | 2.026       | 2.087       | 2.158       | 2.218       | 2.266       | 2.300       | 2.318       |
| <b>1981</b>  | 1.692       | 1.733       | 1.763       | 1.800       | 1.852       | 1.908       | 1.972       | 2.027       | 2.071       | 2.103       | 2.120       |
| <b>1982</b>  | 1.595       | 1.633       | 1.662       | 1.697       | 1.745       | 1.798       | 1.859       | 1.911       | 1.952       | 1.982       | 1.998       |
| <b>1983</b>  | 1.534       | 1.571       | 1.598       | 1.632       | 1.679       | 1.729       | 1.788       | 1.838       | 1.878       | 1.906       | 1.922       |
| <b>1984</b>  | 1.479       | 1.514       | 1.540       | 1.573       | 1.618       | 1.667       | 1.723       | 1.772       | 1.810       | 1.837       | 1.852       |
| <b>1985</b>  | 1.435       | 1.469       | 1.495       | 1.527       | 1.570       | 1.617       | 1.672       | 1.719       | 1.756       | 1.783       | 1.797       |
| <b>1986</b>  | 1.404       | 1.438       | 1.463       | 1.494       | 1.536       | 1.583       | 1.636       | 1.682       | 1.719       | 1.745       | 1.759       |
| <b>1987</b>  | 1.366       | 1.399       | 1.424       | 1.454       | 1.495       | 1.540       | 1.593       | 1.637       | 1.673       | 1.695       | 1.709       |
| <b>1988</b>  | 1.321       | 1.353       | 1.377       | 1.406       | 1.446       | 1.490       | 1.540       | 1.583       | 1.617       | 1.639       | 1.652       |
| <b>1989</b>  | 1.273       | 1.304       | 1.326       | 1.355       | 1.393       | 1.435       | 1.484       | 1.525       | 1.558       | 1.579       | 1.592       |
| <b>1990</b>  | 1.226       | 1.255       | 1.277       | 1.304       | 1.341       | 1.382       | 1.429       | 1.468       | 1.500       | 1.520       | 1.533       |
| <b>1991</b>  | 1.184       | 1.213       | 1.234       | 1.260       | 1.296       | 1.335       | 1.380       | 1.419       | 1.450       | 1.468       | 1.480       |
| <b>1992</b>  | 1.158       | 1.185       | 1.206       | 1.232       | 1.267       | 1.305       | 1.349       | 1.387       | 1.417       | 1.434       | 1.446       |
| <b>1993</b>  | 1.131       | 1.159       | 1.179       | 1.204       | 1.238       | 1.275       | 1.319       | 1.356       | 1.385       | 1.403       | 1.415       |
| <b>1994</b>  | 1.108       | 1.134       | 1.154       | 1.179       | 1.212       | 1.249       | 1.291       | 1.327       | 1.356       | 1.374       | 1.385       |
| <b>1995</b>  | 1.086       | 1.112       | 1.131       | 1.155       | 1.188       | 1.224       | 1.265       | 1.301       | 1.329       | 1.346       | 1.357       |
| <b>1996</b>  | 1.065       | 1.091       | 1.110       | 1.134       | 1.166       | 1.201       | 1.242       | 1.276       | 1.304       | 1.321       | 1.332       |
| <b>1997</b>  | 1.048       | 1.073       | 1.092       | 1.115       | 1.147       | 1.181       | 1.222       | 1.256       | 1.283       | 1.298       | 1.309       |
| <b>1998</b>  | 1.037       | 1.061       | 1.080       | 1.103       | 1.134       | 1.168       | 1.208       | 1.242       | 1.269       | 1.284       | 1.294       |
| <b>1999</b>  | 1.022       | 1.046       | 1.064       | 1.087       | 1.118       | 1.152       | 1.191       | 1.224       | 1.251       | 1.265       | 1.275       |
| <b>2000</b>  | 1.000       | 1.024       | 1.042       | 1.064       | 1.094       | 1.127       | 1.166       | 1.198       | 1.224       | 1.238       | 1.248       |
| <b>2001</b>  | 0.977       | 1.000       | 1.017       | 1.039       | 1.069       | 1.101       | 1.138       | 1.170       | 1.195       | 1.211       | 1.221       |
| <b>2002</b>  | 0.960       | 0.983       | 1.000       | 1.021       | 1.050       | 1.082       | 1.119       | 1.150       | 1.175       | 1.192       | 1.201       |
| <b>2003</b>  | 0.940       | 0.962       | 0.979       | 1.000       | 1.028       | 1.059       | 1.096       | 1.126       | 1.150       | 1.167       | 1.176       |
| <b>2004</b>  | 0.914       | 0.936       | 0.952       | 0.972       | 1.000       | 1.030       | 1.065       | 1.095       | 1.118       | 1.134       | 1.144       |
| <b>2005</b>  | 0.887       | 0.908       | 0.924       | 0.944       | 0.970       | 1.000       | 1.031       | 1.060       | 1.083       | 1.098       | 1.107       |
| <b>2006</b>  | 0.858       | 0.878       | 0.894       | 0.913       | 0.939       | 0.969       | 1.000       | 1.027       | 1.049       | 1.063       | 1.072       |
| <b>2007</b>  | 0.835       | 0.855       | 0.870       | 0.888       | 0.914       | 0.943       | 0.974       | 1.000       | 1.022       | 1.033       | 1.041       |
| <b>2008</b>  | 0.817       | 0.837       | 0.851       | 0.869       | 0.894       | 0.923       | 0.953       | 0.979       | 1.000       | 1.012       | 1.019       |
| <b>2009</b>  | 0.808       | 0.826       | 0.839       | 0.857       | 0.882       | 0.911       | 0.941       | 0.968       | 0.988       | 1.000       | 1.010       |
| <b>2010</b>  | 0.801       | 0.819       | 0.832       | 0.850       | 0.875       | 0.904       | 0.933       | 0.961       | 0.982       | 0.991       | 1.000       |

**Source:**

U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business*, Washington, DC, monthly.



## **APPENDIX C**

### **MAPS**



**Table C.1**  
**Census Regions and Divisions**

| Northeast Region            |                             |                             |                |
|-----------------------------|-----------------------------|-----------------------------|----------------|
| Mid-Atlantic division       |                             | New England division        |                |
| New Jersey                  | Pennsylvania                | Connecticut                 | New Hampshire  |
| New York                    |                             | Maine                       | Rhode Island   |
|                             |                             | Massachusetts               | Vermont        |
| South Region                |                             |                             |                |
| West South Central division | East South Central division | South Atlantic division     |                |
| Arkansas                    | Alabama                     | Delaware                    | South Carolina |
| Louisiana                   | Kentucky                    | Florida                     | Virginia       |
| Oklahoma                    | Mississippi                 | Georgia                     | Washington, DC |
| Texas                       | Tennessee                   | Maryland                    | West Virginia  |
|                             |                             | North Carolina              |                |
| West Region                 |                             |                             |                |
| Pacific division            |                             | Mountain division           |                |
| Alaska                      | Oregon                      | Arizona                     | Nevada         |
| California                  | Washington                  | Colorado                    | New Mexico     |
| Hawaii                      |                             | Idaho                       | Utah           |
|                             |                             | Montana                     | Wyoming        |
| Midwest Region              |                             |                             |                |
| West North Central division |                             | East North Central division |                |
| Iowa                        | Nebraska                    | Illinois                    | Ohio           |
| Kansas                      | North Dakota                | Indiana                     | Wisconsin      |
| Minnesota                   | South Dakota                | Michigan                    |                |
| Missouri                    |                             |                             |                |

**Source:**  
U.S. Census Bureau.

**Figure C1. Census Regions and Divisions**

**Source:**  
See Table C.1.

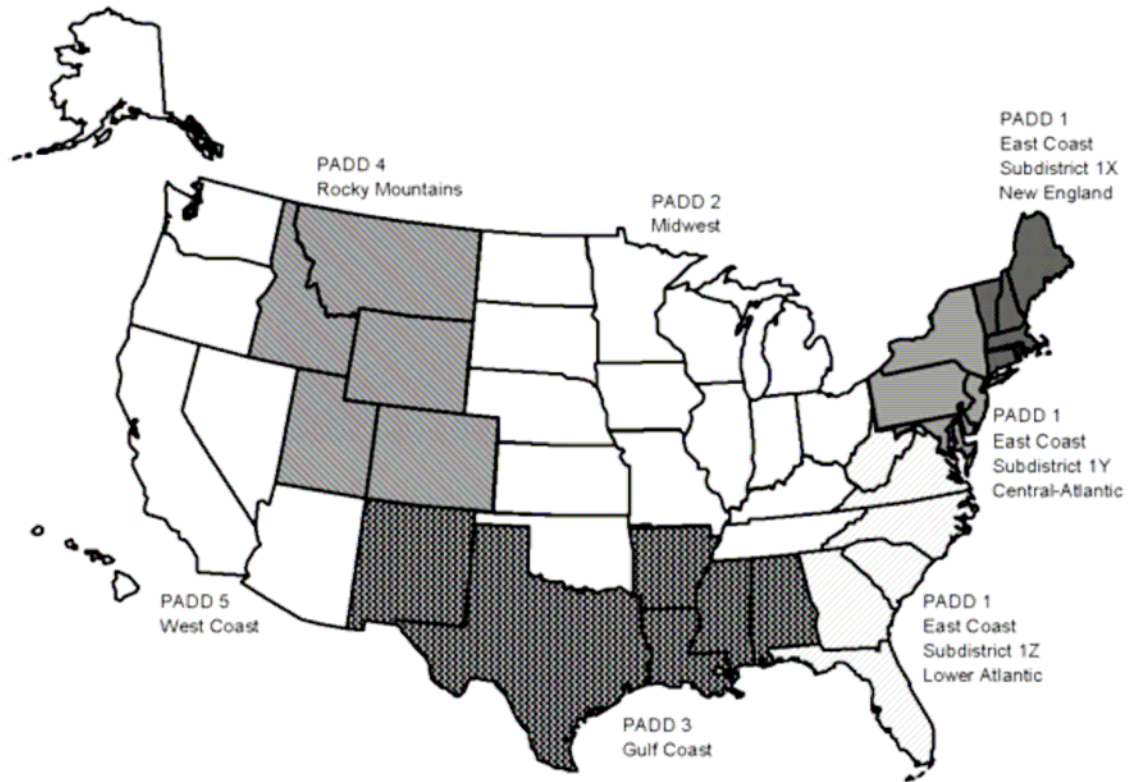
**Table C.2**  
**Petroleum Administration for Defense Districts (PADD)**

| District                          | Subdistrict                        | States   |
|-----------------------------------|------------------------------------|--|
| PAD District 1<br>East Coast      | Subdistrict 1X<br>New England      | Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont  |
|                                   | Subdistrict 1Y<br>Central Atlantic | Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania   |
|                                   | Subdistrict 1Z<br>Lower Atlantic   | Florida, Georgia, North Carolina, South Carolina, Virginia, West Virginia  |
| PAD District 2<br>Midwest         |                                    | Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Ohio, Oklahoma, Tennessee, Wisconsin |
| PAD District 3<br>Gulf Coast      |                                    | Alabama, Arkansas, Louisiana, Mississippi, New Mexico, Texas   |
| PAD District 4<br>Rocky Mountains |                                    | Colorado Idaho, Montana, Utah, Wyoming   |
| PAD District 5<br>West Coast      |                                    | Alaska, Arizona, California, Hawaii, Nevada, Oregon, Washington  |

**Source:**

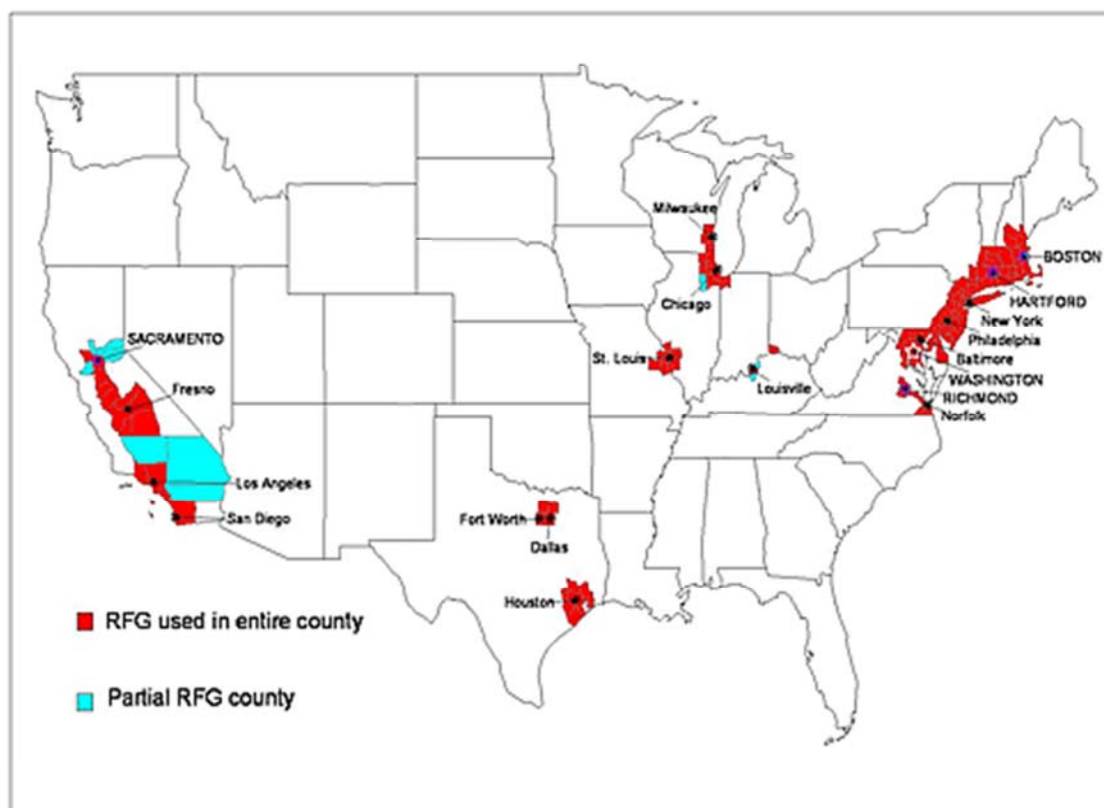
Energy Information Administration web site: <http://tonto.eia.doe.gov/oog/info/twip/padddef.html>

**Figure C.2. Petroleum Administration for Defense Districts**



**Source:**  
See Table C.2.

**Figure C.3. Map of Places where Reformulated Gasoline is Sold**



**Source:**

U.S. Environmental Protection Agency, [www.epa.gov/otaq/rfg/whereyoulive.htm](http://www.epa.gov/otaq/rfg/whereyoulive.htm).

**Note:** Reformulated gasoline is a motor gasoline specially formulated to achieve significant reductions in vehicle emissions of ozone-forming and toxic air pollutants. The Clean Air Act of 1990 mandates reformulated gasoline use in areas with ozone-air pollution problems.





## GLOSSARY

**Acceleration power** – Measured in kilowatts. Pulse power obtainable from a battery used to accelerate a vehicle. This is based on a constant current pulse for 30 seconds at no less than 2/3 of the maximum open-circuit-voltage, at 80% depth-of-discharge relative to the battery's rated capacity and at 20° C ambient temperature.

**Air Carrier** – The commercial system of air transportation consisting of certificated air carriers, air taxis (including commuters), supplemental air carriers, commercial operators of large aircraft, and air travel clubs.

**Certificated route air carrier:** An air carrier holding a Certificate of Public Convenience and Necessity issued by the Department of Transportation to conduct scheduled interstate services. Nonscheduled or charter operations may also be conducted by these carriers. These carriers operate large aircraft (30 seats or more, or a maximum payload capacity of 7,500 pounds or more) in accordance with Federal Aviation Regulation part 121.

**Domestic air operator:** Commercial air transportation within and between the 50 States and the District of Columbia. Includes operations of certificated route air carriers, Pan American, local service, helicopter, intra-Alaska, intra-Hawaii, all-cargo carriers and other carriers. Also included are transborder operations conducted on the domestic route segments of U.S. air carriers. Domestic operators are classified based on their operating revenue as follows:

- Majors - over \$1 billion
- Nationals - \$100-1,000 million
- Large Regionals - \$10-99.9 million
- Medium Regionals - \$0-9.99 million

**International air operator:** Commercial air transportation outside the territory of the United States, including operations between the U.S. and foreign countries and between the U.S. and its territories and possessions.

**Supplemental air carrier:** A class of air carriers which hold certificates authorizing them to perform passenger and cargo charter services supplementing the scheduled service of the certificated route air carriers. Supplemental air carriers are often referred to as nonscheduled air carriers or "nonskeds."

**Alcohol** – The family name of a group of organic chemical compounds composed of carbon, hydrogen, and oxygen. The molecules in the series vary in chain length and are composed of a hydrocarbon plus a hydroxyl group. Alcohol includes methanol and ethanol.

**Alternative fuel** – For transportation applications, includes the following: methanol; denatured ethanol, and other alcohols; fuel mixtures containing 85 percent or more by volume of methanol, denatured ethanol, and other alcohols with gasoline or other fuels; natural gas; liquefied petroleum gas (propane); hydrogen; coal-derived liquid fuels; fuels (other than alcohol) derived from biological materials (biofuels such as soy diesel fuel); and electricity (including electricity from solar energy). The term "alternative fuel" does not include alcohol or other blended portions of primarily petroleum-based fuels used as oxygenates or extenders, i.e. MTBE, ETBE, other ethers, and the 10-percent ethanol portion of gasohol.

**Amtrak** – See Rail.

**Anthropogenic** – Human made. Usually used in the context of emissions that are produced as the result of human activities.

**Automobile size classifications** – Size classifications of automobiles are established by the Environmental Protection Agency (EPA) as follows:

Minicompact – less than 85 cubic feet of passenger and luggage volume.

Subcompact – between 85 to 100 cubic feet of passenger and luggage volume.

Compact – between 100 to 110 cubic feet of passenger and luggage volume.

Midsized – between 110 to 120 cubic feet of passenger and luggage volume.

Large – more than 120 cubic feet of passenger and luggage volume.

Two seater – automobiles designed primarily to seat only two adults.

Station wagons are included with the size class for the sedan of the same name.

**Aviation** – See *General aviation*.

**Aviation gasoline** – All special grades of gasoline for use in aviation reciprocating engines, as given in the American Society for Testing and Materials (ASTM) Specification D 910. Includes all refinery products within the gasoline range that are to be marketed straight or in blends as aviation gasoline without further processing (any refinery operation except mechanical blending). Also included are finished components in the gasoline range which will be used for blending or compounding into aviation gasoline.

**Barges** – Shallow, nonself-propelled vessels used to carry bulk commodities on the rivers and the Great Lakes.

**Battery efficiency** – Measured in percentage. Net DC energy delivered on discharge, as a percentage of the total DC energy required to restore the initial state-of-charge. The efficiency value must include energy losses resulting from self-discharge, cell equalization, thermal loss compensation, and all battery-specific auxiliary equipment.

**Btu** – British thermal unit. The amount of energy required to raise the temperature of 1 pound of water 1 degree Fahrenheit at or near 39.2 degrees Fahrenheit. An average Btu content of fuel is the heat value per quantity of fuel as determined from tests of fuel samples.

**Bunker** – A storage tank.

**Bunkering fuels** – Fuels stored in ship bunkers.

**Bus** – A mode of transit service characterized by roadway vehicles powered by diesel, gasoline, battery, or alternative fuel engines contained within the vehicle.

**Intercity bus:** A standard size bus equipped with front doors only, high backed seats, luggage compartments separate from the passenger compartment and usually with restroom facilities, for high-speed long distance service.

**Motor bus:** Rubber-tired, self-propelled, manually-steered bus with fuel supply on board the vehicle. Motor bus types include intercity, school, and transit.

**School and other nonrevenue bus:** Bus services for which passengers are not directly charged for transportation, either on a per passenger or per vehicle basis.

**Transit bus:** A bus designed for frequent stop service with front and center doors, normally with a rear-mounted diesel engine, low-back seating, and without luggage storage compartments or restroom facilities.

**Trolley coach:** Rubber-tired electric transit vehicle, manually-steered, propelled by a motor drawing current, normally through overhead wires, from a central power source not on board the vehicle.

**Calendar year** – The period of time between January 1 and December 31 of any given year.

**Captive imports** – Products produced overseas specifically for domestic manufacturers.

**Carbon dioxide (CO<sub>2</sub>)** – A colorless, odorless, non-poisonous gas that is a normal part of the ambient air. Carbon dioxide is a product of fossil fuel combustion.

**Carbon monoxide (CO)** – A colorless, odorless, highly toxic gas that is a by-product of incomplete fossil fuel combustion. Carbon monoxide, one of the major air pollutants, can be harmful in small amounts if breathed over a certain period of time.

**Car-mile (railroad)** – A single railroad car moved a distance of one mile.

**Cargo ton-mile** – See *Ton-mile*.

**Certificated route air carriers** – See *Air carriers*.

**Class I freight railroad** – See *Rail*.

**Coal slurry** – Finely crushed coal mixed with sufficient water to form a fluid.

**Combination trucks** – Consist of a power unit (a truck tractor) and one or more trailing units (a semi-trailer or trailer). The most frequently used combination is popularly referred to as a "tractor-semitrailer" or "tractor trailer".

**Commercial sector** – An energy-consuming sector that consists of service-providing facilities of: businesses; Federal, State, and local governments; and other private and public organizations, such as religious, social or fraternal groups. Includes institutional living quarters.

**Commuter rail** – A mode of transit service (also called metropolitan rail, regional rail, or suburban rail) characterized by an electric or diesel propelled railway for urban passenger train service consisting of local short distance travel operating between a central city and adjacent suburbs.

**Compact car** – See *Automobile size classifications*.

**Compression ignition** – The form of ignition that initiates combustion in a diesel engine. The rapid compression of air within the cylinders generates the heat required to ignite the fuel as it is injected.

**Constant dollars** – A time series of monetary figures is expressed in constant dollars when the effect of change over time in the purchasing power of the dollar has been removed. Usually the data are expressed in terms of dollars of a selected year or the average of a set of years.

**Consumer Price Index (CPI)** – A measure of the average change over time in the prices paid by urban consumers for a market basket of consumer goods and services.

**Continuous discharge capacity** – Measured as percent of rated energy capacity. Energy delivered in a constant power discharge required by an electric vehicle for hill climbing and/or high-speed cruise, specified as the percent of its rated energy capacity delivered in a one hour constant-power discharge.

**Conventional Refueling Station** – An establishment for refueling motor vehicles with traditional transportation fuels, such as gasoline and diesel fuel.

**Corporate Average Fuel Economy (CAFE) Standards** – CAFE standards were originally established by Congress for new automobiles, and later for light trucks, in Title V of the Motor Vehicle Information and Cost Savings Act (15 U.S.C.1901, et seq.) with subsequent amendments. Under CAFE, automobile manufacturers are required by law to produce vehicle fleets with a composite sales-weighted fuel economy which cannot be lower than the CAFE standards in a given year, or for every vehicle which does not meet the standard, a fine of \$5.00 is paid for every one-tenth of a mpg below the standard.

**Criteria pollutant** – A pollutant determined to be hazardous to human health and regulated under EPA's National Ambient Air Quality Standards. The 1970 amendments to the Clean Air Act require EPA to describe the health and welfare impacts of a pollutant as the "criteria" for inclusion in the regulatory regime.

**Crude oil** – A mixture of hydrocarbons that exists in the liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities. Crude oil production is measured at the wellhead and includes lease condensate.

**Crude oil imports** – The volume of crude oil imported into the 50 States and the District of Columbia, including imports from U.S. territories, but excluding imports of crude oil into the Hawaiian Foreign Trade Zone.

**Curb weight** – The weight of a vehicle including all standard equipment, spare tire and wheel, all fluids and lubricants to capacity, full tank of fuel, and the weight of major optional accessories normally found on the vehicle.

**Current dollars** – Represents dollars current at the time designated or at the time of the transaction. In most contexts, the same meaning would be conveyed by the use of the term "dollars." See also constant dollars.

**Demand Response** – A transit mode that includes passenger cars, vans, and small buses operating in response to calls from passengers to the transit operator who dispatches the vehicles. The vehicles do not operate over a fixed route on a fixed schedule. Can also be known as paratransit or dial-a-ride.

**Diesel fuel** – See *Distillate fuel oil*.

**Disposable personal income** – See *Income*.

**Distillate fuel oil** – The lighter fuel oils distilled off during the refining process. Included are products known as ASTM grades numbers 1 and 2 heating oils, diesel fuels, and number 4 fuel oil. The major uses of distillate fuel oils include heating, fuel for on-and off-highway diesel engines, and railroad diesel fuel.

**Domestic air operator** – See *Air carrier*.

**Domestic water transportation** – See *Internal water transportation*.

**E85** – 85% ethanol and 15% gasoline.

**E95** – 95% ethanol and 5% gasoline.

**Electric utilities sector** – Consists of privately and publicly owned establishments which generate electricity primarily for resale.

**Emission standards** – Limits or ranges established for pollution levels emitted by vehicles as well as stationary sources. The first standards were established under the 1963 Clean Air Act.

**End-use sector** – See *Sector*.

**Energy capacity** – Measured in kilowatt hours. The energy delivered by the battery, when tested at C/3 discharge rate, up to termination of discharge specified by the battery manufacturer. The required acceleration power must be delivered by the battery at any point up to 80% of the battery's energy capacity rating.

**Energy efficiency** – In reference to transportation, the inverse of energy intensiveness: the ratio of outputs from a process to the energy inputs; for example, miles traveled per gallon of fuel (mpg).

**Energy intensity** – In reference to transportation, the ratio of energy inputs to a process to the useful outputs from that process; for example, gallons of fuel per passenger-mile or Btu per ton-mile.

**Ethanol (C<sub>2</sub>H<sub>5</sub>OH)** – Otherwise known as ethyl alcohol, alcohol, or grain-spirit. A clear, colorless, flammable oxygenated hydrocarbon with a boiling point of 78.5 degrees Celsius in the anhydrous state. In transportation, ethanol is used as a vehicle fuel by itself (E100 – 100% ethanol by volume), blended with gasoline (E85 – 85% ethanol by volume), or as a gasoline octane enhancer and oxygenate (10% by volume).

**Excise tax** – Paid when purchases are made on a specific good, such as gasoline. Excise taxes are often included in the price of the product. There are also excise taxes on activities, such as highway usage by trucks.

**Ferry boat** – A transit mode comprising vessels carrying passengers and in some cases vehicles over a body of water, and that are generally steam or diesel-powered.

**Fixed operating cost** – See *Operating cost*.

**Fleet vehicles** –

**Private fleet vehicles:** Ideally, a vehicle could be classified as a member of a fleet if it is:

- a) operated in mass by a corporation or institution,
- b) operated under unified control, or
- c) used for non-personal activities.

However, the definition of a fleet is not consistent throughout the fleet industry. Some companies make a distinction between cars that were bought in bulk rather than singularly, or whether they are operated in bulk, as well as the minimum number of vehicles that constitute a fleet (i.e. 4 or 10).

**Government fleet vehicles:** Includes vehicles owned by all Federal, state, county, city, and metro units of government, including toll road operations.

**Foreign freight** – Movements between the United States and foreign countries and between Puerto Rico, the Virgin Islands, and foreign countries. Trade between U.S. territories and possessions (e.g. Guam, Wake, American Samoa) and foreign countries is excluded. Traffic to or from the Panama Canal Zone is included.

**Gas Guzzler Tax** – Originates from the 1978 Energy Tax Act (Public Law 95-618). A new car purchaser is required to pay the tax if the car purchased has a combined city/highway fuel economy rating that is below the standard for that year. For model years 1986 and later, the standard is 22.5 mpg.

**Gasohol** – A mixture of 10% anhydrous ethanol and 90% gasoline by volume; 7.5% anhydrous ethanol and 92.5% gasoline by volume; or 5.5% anhydrous ethanol and 94.5% gasoline by volume. There are other fuels that contain methanol and gasoline, but these fuels are not referred to as gasohol.

**Gasoline** – See *Motor gasoline*.

**General aviation** – That portion of civil aviation which encompasses all facets of aviation except air carriers. It includes any air taxis, commuter air carriers, and air travel clubs which do not hold Certificates of Public Convenience and Necessity.

**Global warming potential (GWP)** – An index used to compare the relative radiative forcing of different gases without directly calculating the changes in atmospheric concentrations. GWPs are calculated as the ratio of the radiative forcing that would result from the emission of one kilogram of a greenhouse gas to that from the emission of one kilogram of carbon dioxide over a fixed period of time, such as 100 years.

**Greenhouse gases** – Those gases, such as water vapor, carbon dioxide, nitrous oxide, methane, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride, that are transparent to solar (short-wave) radiation but opaque to long-wave (infrared) radiation, thus preventing long-wave radiant energy from leaving Earth's atmosphere. The net effect is a trapping of absorbed radiation and a tendency to warm the planet's surface.

**Gross National Product** – A measure of monetary value of the goods and services becoming available to the nation from economic activity. Total value at market prices of all goods and services produced by the nation's economy. Calculated quarterly by the Department of Commerce, the Gross National Product is the broadest available measure of the level of economic activity.

**Gross vehicle weight (gvw)** – The weight of the empty truck plus the maximum anticipated load weight.

**Gross vehicle weight rating (gvwr)** – The gross vehicle weight which is assigned to each new truck by the manufacturer. This rating may be different for trucks of the same model because of certain features, such as heavy-duty suspension. Passenger cars do not have gross vehicle weight ratings.

**Heavy-heavy truck** – See *Truck size classifications*.

**Heavy rail** – A mode of transit service (also called metro, subway, rapid transit, or rapid rail) operating on an electric railway with the capacity for a heavy volume of traffic. Characterized by high speed and rapid acceleration of passenger rail cars.

**Household** – Consists of all persons who occupy a housing unit, including the related family members and all unrelated persons, if any, who share the housing unit.

**Housing unit** – A house, apartment, a group of rooms, or a single room occupied or intended for occupancy as separate living quarters. Separate living quarters are those in which the occupants do not live and eat with any other persons in the structure and which have either (1) direct access from the outside of the building or through a common hallway intended to be used by the occupants of another unit or by the general public, or (2) complete kitchen facilities for the exclusive use of the occupants. The occupants may be a single family, one person living alone, two or more families living together, or any other group of related or unrelated persons who share living arrangements.

**Hybrid-electric vehicles** – Combines the benefits of gasoline engines and electric motors and can be configured to obtain different objectives, such as improved fuel economy, increased power, or additional auxiliary power for electronic devices and power tools.

**Hydrocarbon (HC)** – A compound that contains only hydrogen and carbon. The simplest and lightest forms of hydrocarbon are gaseous. With greater molecular weights they are liquid, while the heaviest are solids.

**Income** –

**Disposable personal income:** Personal income less personal tax and non-tax payments.

**National income:** The aggregate earnings of labor and property which arise in the current production of goods and services by the nation's economy.

**Personal income:** The current income received by persons from all sources, net of contributions for social insurance.

**Industrial sector** – Construction, manufacturing, agricultural and mining establishments.

**Inertia weight** – The curb weight of a vehicle plus 300 pounds.

**Intercity bus** – See *Bus*.

**Intermodal** – Transportation activities involving more than one mode of transportation, including transportation connections and coordination of various modes.

**Internal water transportation** – Includes all local (intraport) traffic and traffic between ports or landings wherein the entire movement takes place on inland waterways. Also termed internal are movements involving carriage on both inland waterways and the water of the Great Lakes, and inland movements that cross short stretches of open water that link inland systems.

**International air operator** – See *Air carrier*.

**International freight** – See *Foreign freight*.

**Jet fuel** – Includes both naphtha-type and kerosene-type fuels meeting standards for use in aircraft turbine engines. Although most jet fuel is used in aircraft, some is used for other purposes such as generating electricity in gas turbines.

**Kerosene-type jet fuel:** A quality kerosene product with an average gravity of 40.7 degrees API and 10% to 90% distillation temperatures of 217 to 261 degrees centigrade. Used primarily as fuel for commercial turbojet and turboprop aircraft engines. It is a relatively low freezing point distillate of the kerosene type.

**Naphtha-type jet fuel:** A fuel in the heavy naphtha boiling range with an average gravity of 52.8 degrees API and 10% to 90% distillation temperatures of 117 to 233 degrees centigrade used for turbojet and turboprop aircraft engines, primarily by the military. Excludes ramjet and petroleum.

**Kerosene** – A petroleum distillate in the 300 to 500 degrees Fahrenheit boiling range and generally having a flash point higher than 100 degrees Fahrenheit by the American Society of Testing and Material (ASTM) Method D56, a gravity range from 40 to 46 degrees API, and a burning point in the range of 150 to 175 degrees Fahrenheit. It is a clean-burning product suitable for use as an illuminant when burned in wick lamps. Includes grades of kerosene called range oil having properties similar to Number 1 fuel oil, but with a gravity of about 43 degrees API and an end point of 625 degrees Fahrenheit. Used in space heaters, cooking stoves, and water heaters.

**Kerosene-type jet fuel** – See Jet fuel.

**Large car** – See *Automobile size classifications*.

**Lease Condensate** – A liquid recovered from natural gas at the well or at small gas/oil separators in the field. Consists primarily of pentanes and heavier hydrocarbons (also called field condensate).

**Light duty vehicles** – Automobiles and light trucks combined.

**Light truck** – Unless otherwise noted, light trucks are defined in this publication as two-axle, four-tire trucks. The U.S. Bureau of Census classifies all trucks with a gross vehicle weight less than 10,000 pounds as light trucks (See Truck size classifications).

**Light-heavy truck** – See *Truck size classifications*.

**Light rail** – Mode of transit service (also called streetcar, tramway or trolley) operating passenger rail cars singly (or in short, usually two-car or three-car trains) on fixed rails in right-of-way that is often separated from other traffic for part or much of the way.

**Liquefied petroleum gas (lpg)** – Consists of propane and butane and is usually derived from natural gas. In locations where there is no natural gas and the gasoline consumption is low, naphtha is converted to lpg by catalytic reforming.

**Load factor** – Total passenger miles divided by total vehicle miles.

**Low emission vehicle** – Any vehicle certified to the low emission standards which are set by the Federal government and/or the state of California.

**M85** – 85% methanol and 15% gasoline.

**M100** – 100% methanol.

**Medium truck** – See *Truck size classifications*.

**Methanol (CH<sub>3</sub>OH)** – A colorless highly toxic liquid with essentially no odor and very little taste. It is the simplest alcohol and boils at 64.7 degrees Celsius. In transportation, methanol is used as a vehicle fuel by itself (M100), or blended with gasoline (M85).

**Midsized car** – See *Automobile size classifications*.



**Minicompact car** – See *Automobile size classifications*.

**Model year** – In this publication, model year is referring to the "sales" model year, the period from October 1 to the next September 31.

**Motor bus** – See *Bus*.

**Motor gasoline** – A mixture of volatile hydrocarbons suitable for operation of an internal combustion engine whose major components are hydrocarbons with boiling points ranging from 78 to 217 degrees centigrade and whose source is distillation of petroleum and cracking, polymerization, and other chemical reactions by which the naturally occurring petroleum hydrocarbons are converted into those that have superior fuel properties.

**Regular gasoline:** Gasoline having an antiknock index, i.e., octane rating, greater than or equal to 85 and less than 88. Note: Octane requirements may vary by altitude.

**Midgrade gasoline:** Gasoline having an antiknock index, i.e., octane rating, greater than or equal to 88 and less than or equal to 90. Note: Octane requirements may vary by altitude.

**Premium gasoline:** Gasoline having an antiknock index, i.e., octane rating, greater than 90. Note: Octane requirements may vary by altitude.

**Reformulated gasoline:** Finished motor gasoline formulated for use in motor vehicles, the composition and properties of which meet the requirements of the reformulated gasoline regulations promulgated by the U.S. Environmental Protection Agency under Section 211(k) of the Clean Air Act. For details on this clean fuel program see <http://www.epa.gov/otaq/rfg.htm>. Note: This category includes oxygenated fuels program reformulated gasoline (OPRG) but excludes reformulated gasoline blendstock for oxygenate blending (RBOB).

**MTBE** – Methyl Tertiary Butyl Ether—a colorless, flammable, liquid oxygenated hydrocarbon containing 18.15 percent oxygen.

**Naphtha-type jet fuel** – See *Jet fuel*.

**National income** – See *Income*.

**Nationwide Personal Transportation Survey (NPTS)** – A nationwide survey of households that provides information on the characteristics and personal travel patterns of the U.S. population. Surveys were conducted in 1969, 1977, 1983, 1990, and 1995 by the U.S. Bureau of Census for the U.S. Department of Transportation.

**Natural gas** – A mixture of hydrocarbon compounds and small quantities of various non-hydrocarbons existing in the gaseous phase or in solution with crude oil in natural underground reservoirs at reservoir conditions.

**Natural gas, dry:** Natural gas which remains after: 1) the liquefiable hydrocarbon portion has been removed from the gas stream; and 2) any volumes of nonhydrocarbon gases have been removed where they occur in sufficient quantity to render the gas unmarketable. Dry natural gas is also known as consumer-grade natural gas. The parameters for measurement are cubic feet at 60 degrees Fahrenheit and 14.73 pounds per square inch absolute.

**Natural gas, wet:** The volume of natural gas remaining after removal of lease condensate in lease and/or field separation facilities, if any, and after exclusion of nonhydrocarbon gases where they

occur in sufficient quantity to render the gas unmarketable. Natural gas liquids may be recovered from volumes of natural gas, wet after lease separation, at natural gas processing plants.

**Natural gas plant liquids:** Natural gas liquids recovered from natural gas in processing plants and from natural gas field facilities and fractionators. Products obtained include ethane, propane, normal butane, isobutane, pentanes plus, and other products from natural gas processing plants.

**Nitrogen oxides (NO<sub>x</sub>)** – A product of combustion of fossil fuels whose production increases with the temperature of the process. It can become an air pollutant if concentrations are excessive.

**Nonattainment area** – Any area that does not meet the national primary or secondary ambient air quality standard established by the Environmental Protection Agency for designated pollutants, such as carbon monoxide and ozone.

**Oil Stocks** – Oil stocks include crude oil (including strategic reserves), unfinished oils, natural gas plant liquids, and refined petroleum products.

**Operating cost** –

**Fixed operating cost:** In reference to passenger car operating cost, refers to those expenditures that are independent of the amount of use of the car, such as insurance costs, fees for license and registration, depreciation and finance charges.

**Variable operating cost:** In reference to passenger car operating cost, expenditures which are dependent on the amount of use of the car, such as the cost of gas and oil, tires, and other maintenance.

**Organization for Economic Cooperation and Development (OECD)** – Consists of Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, South Korea, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States. Total OECD includes the United States Territories (Guam, Puerto Rico, and the U.S. Virgin Islands). Total OECD excludes data for Czech Republic, Hungary, Mexico, Poland, and South Korea which are not yet available.

**OECD Europe:** Consists of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, and United Kingdom. OECD Europe excludes data for Czech Republic, Hungary, and Poland which are not yet available.

**OECD Pacific:** Consists of Australia, Japan, and New Zealand.

**Organization for Petroleum Exporting Countries (OPEC)** – Includes Saudi Arabia, Iran, Venezuela, Libya, Indonesia, United Arab Emirates, Algeria, Nigeria, Ecuador, Gabon, Iraq, Kuwait, and Qatar. Data for Saudi Arabia and Kuwait include their shares from the Partitioned Zone (formerly the Neutral Zone). Angola joined OPEC in December 2006, thus, beginning in 2007, data on OPEC will include Angola.

**Arab OPEC** – Consists of Algeria, Iraq, Kuwait, Libya, Qatar, Saudi Arabia and the United Arab Emirates.

**Other single-unit truck** – See *Single-unit truck*.

**Oxygenate** – A substance which, when added to gasoline, increases the amount of oxygen in that gasoline blend. Includes fuel ethanol, methanol, and methyl tertiary butyl ether (MTBE).

**Paratransit** – Mode of transit service (also called demand response or dial-a-ride) characterized by the use of passenger automobiles, vans or small buses operating in response to calls from passengers or their agents to the transit operator, who then dispatches a vehicle to pick up the passengers and transport them to their destinations.

**Particulates** – Carbon particles formed by partial oxidation and reduction of the hydrocarbon fuel. Also included are trace quantities of metal oxides and nitrides, originating from engine wear, component degradation, and inorganic fuel additives. In the transportation sector, particulates are emitted mainly from diesel engines.

**Passenger-miles traveled (PMT)** – One person traveling the distance of one mile. Total passenger-miles traveled, thus, give the total mileage traveled by all persons.

**Passenger rail** – See *Rail*, "*Amtrak*" and "*Transit Railroad*".

**Persian Gulf countries** – Consists of Bahrain, Iran, Iraq, Kuwait, Qatar, Saudi Arabia, and the United Emirates.

**Personal Consumption Expenditures (PCE)** – As used in the national accounts, the market value of purchases of goods and services by individuals and nonprofit institutions and the value of food, clothing, housing, and financial services received by them as income in kind. It includes the rental value of owner-occupied houses but excludes purchases of dwellings, which are classified as capital goods (investment).

**Personal income** – See *Income*.

**Petroleum** – A generic term applied to oil and oil products in all forms, such as crude oil, lease condensate, unfinished oil, refined petroleum products, natural gas plant liquids, and non-hydrocarbon compounds blended into finished petroleum products.

**Petroleum consumption:** A calculated demand for petroleum products obtained by summing domestic production, imports of crude petroleum and natural gas liquids, imports of petroleum products, and the primary stocks at the beginning of the period and then subtracting the exports and the primary stocks at the end of the period.

**Petroleum exports:** Shipments of petroleum products from the 50 States and the District of Columbia to foreign countries, Puerto Rico, the Virgin Islands, and other U.S. possessions and territories.

**Petroleum imports:** All imports of crude petroleum, natural gas liquids, and petroleum products from foreign countries and receipts from Guam, Puerto Rico, the Virgin Islands, and the Hawaiian Trade Zone. The commodities included are crude oil, unfinished oils, plant condensate, and refined petroleum products.

**Petroleum inventories:** The amounts of crude oil, unfinished oil, petroleum products, and natural gas liquids held at refineries, at natural gas processing plants, in pipelines, at bulk terminals operated by refining and pipeline companies, and at independent bulk terminals. Crude oil held in storage on leases is also included; these stocks are known as primary stocks. Secondary stocks—those held by jobbers dealers, service station operators, and consumers—are

excluded. Prior to 1975, stock held at independent bulk terminals were classified as secondary stocks.

**Petroleum products supplied:** For each petroleum product, the amount supplied is calculated by summing production, crude oil burned directly, imports, and net withdrawals from primary stocks and subtracting exports.

**Plug-in hybrid-electric vehicles (PHEVs)** — Hybrid-electric vehicles with high capacity batteries that can be charged by plugging them into an electrical outlet or charging station. There are two basic PHEV configurations:

**Parallel or Blended PHEV:** Both the engine and electric motor are mechanically connected to the wheels, and both propel the vehicle under most driving conditions. Electric-only operation usually occurs only at low speeds.

**Series PHEVs, also called Extended Range Electric Vehicles (EREVs):** Only the electric motor turns the wheels; the gasoline engine is only used to generate electricity. Series PHEVs can run solely on electricity until the battery needs to be recharged. The gasoline engine will then generate the electricity needed to power the electric motor. For shorter trips, these vehicles might use no gasoline at all.

**Processing Gain** – The amount by which the total volume of refinery output is greater than the volume of input for given period of time. The processing gain arises when crude oil and other hydrocarbons are processed into products that are, on average, less dense than the input.

**Processing Loss** – The amount by which the total volume of refinery output is less than the volume of input for given period of time. The processing loss arises when crude oil and other hydrocarbons are processed into products that are, on average, more dense than the input.

**Proved Reserves of Crude Oil** – The estimated quantities of all liquids defined as crude oil, which geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions.

**Quad** – Quadrillion,  $10^{15}$ . In this publication, a Quad refers to Quadrillion Btu.

**Rail** –

**Amtrak (American Railroad Tracks):** Operated by the National Railroad Passenger Corporation of Washington, DC. This rail system was created by President Nixon in 1970, and was given the responsibility for the operation of intercity, as distinct from suburban, passenger trains between points designated by the Secretary of Transportation.

**Class I freight railroad:** Defined by the Interstate Commerce Commission each year based on annual operating revenue. A railroad is dropped from the Class I list if it fails to meet the annual earnings threshold for three consecutive years.

**Commuter railroad:** Those portions of mainline railroad (not electric railway) transportation operations which encompass urban passenger train service for local travel between a central city and adjacent suburbs. Commuter railroad service—using both locomotive-hauled and self-propelled railroad passenger cars—is characterized by multi-trip tickets, specific station-to-station fares, and usually only one or two stations in the central business district. Also known as suburban railroad.

**Transit railroad:** Includes "heavy" and "light" transit rail. **Heavy transit rail** is characterized by exclusive rights-of-way, multi-car trains, high speed rapid acceleration, sophisticated signaling, and high platform loading. Also known as subway, elevated railway, or metropolitan railway (metro). **Light transit rail** may be on exclusive or shared rights-of-way, high or low platform loading, multi-car trains or single cars, automated or manually operated. In generic usage, light rail includes streetcars, trolley cars, and tramways.

**Refiner sales price** – Sales from the refinery made directly to ultimate consumers, including bulk consumers (such as agriculture, industry, and electric utilities) and residential and commercial consumers.

**Reformulated gasoline (RFG)** – See *Motor gasoline*.

**RFG area** – An ozone nonattainment area designated by the Environmental Protection Agency which requires the use of reformulated gasoline.

**Residential sector** – An energy consuming sector that consists of living quarters for private households. Excludes institutional living quarters.

**Residential Transportation Energy Consumption Survey (RTECS)** – This survey was designed by the Energy Information Administration of the Department of Energy to provide information on how energy is used by households for personal vehicles. It has been conducted five times since 1979, the most recent being 1991.

**Residual fuel oil** – The heavier oils that remain after the distillate fuel oils and lighter hydrocarbons are boiled off in refinery operations. Included are products known as ASTM grade numbers 5 and 6 oil, heavy diesel oil, Navy Special Fuel Oil, Bunker C oil, and acid sludge and pitch used as refinery fuels. Residual fuel oil is used for the production of electric power, for heating, and for various industrial purposes.

**Rural** – Usually refers to areas with population less than 5,000.

**Sales period** – October 1 of the previous year to September 30 of the given year. Approximately the same as a model year.

**Sales-weighted miles per gallon (mpg)** – Calculation of a composite vehicle fuel economy based on the distribution of vehicle sales.

**Scrappage rate** – As applied to motor vehicles, it is usually expressed as the percentage of vehicles of a certain type in a given age class that are retired from use (lacking registration) in a given year.

**School and other nonrevenue bus** – See *Bus*.

**Sector** – A group of major energy-consuming components of U.S. society developed to measure and analyze energy use. The sectors most commonly referred to are: residential, commercial, industrial, transportation, and electric power.

**Single-unit truck** – Includes two-axle, four-tire trucks and other single-unit trucks.

**Two-axle, four-tire truck:** A motor vehicle consisting primarily of a single motorized device with two axles and four tires.

**Other single-unit truck:** A motor vehicle consisting primarily of a single motorized device with more than two axles or more than four tires.

**Spark ignition engine** – An internal combustion engine in which the charge is ignited electrically (e.g., with a spark plug).

**Special fuels** – Consist primarily of diesel fuel with small amount of liquified petroleum gas, as defined by the Federal Highway Administration.

**Specific acceleration power** – Measured in watts per kilogram. Acceleration power divided by the battery system weight. Weight must include the total battery system.

**Specific energy** – Measured in watt hours per kilogram. The rated energy capacity of the battery divided by the total battery system weight.

**Subcompact car** – See *Automobile size classifications*.

**Supplemental air carrier** – See *Air carrier*.

**Survival rate** – As applied to motor vehicles, it is usually expressed as the percentage of vehicles of a certain type in a given age class that will be in use at the end of a given year.

**Tax incentives** – In general, a means of employing the tax code to stimulate investment in or development of a socially desirable economic objective without direct expenditure from the budget of a given unit of government. Such incentives can take the form of tax exemptions or credits.

**Test weight** – The weight setting at which a vehicle is tested on a dynamometer by the U.S. Environmental Protection Agency (EPA). This weight is determined by the EPA using the inertia weight of the vehicle.

**Ton-mile** – The movement of one ton of freight the distance of one mile. Ton-miles are computed by multiplying the weight in tons of each shipment transported by the distance hauled.

**Transmission types** –

- A3 – Automatic three speed
- A4 – Automatic four speed
- A5 – Automatic five speed
- L4 – Automatic lockup four speed
- M5 – Manual five speed

**Transit bus** – See *Bus*.

**Transit railroad** – See *Rail*.

**Transportation sector** – Consists of both private and public passenger and freight transportation, as well as government transportation, including military operations.

**Truck Inventory and Use Survey (TIUS)** – Survey designed to collect data on the characteristics and operational use of the nation's truck population. It is conducted every five years by the U.S. Bureau of the Census. Surveys were conducted in 1963, 1967, 1972, 1977, 1982, 1987, and 1992. For the 1997 survey, it was renamed the Vehicle Inventory and Use Survey in anticipation

of including additional vehicle types. However, no additional vehicle types were added to the 1997 survey.

**Trolleybus** – Mode of transit service (also called transit coach) using vehicles propelled by a motor drawing current from overhead wires via connecting poles called a trolley pole, from a central power source not onboard the vehicle.

**Truck size classifications** – U.S. Bureau of the Census has categorized trucks by gross vehicle weight (gvw) as follows:

Light – Less than 10,000 pounds gvw (Also see Light Truck.)

Medium – 10,001 to 20,000 pounds gvw

Light-heavy – 20,001 to 26,000 pounds gvw

Heavy-heavy – 26,001 pounds gvw or more.

**Two-axle, four-tire truck** – See *Single-unit truck*.

**Two seater car** – See *Automobile size classifications*.

**Ultra-low emission vehicle** – Any vehicle certified to the ultra-low emission standards which are set by the Federal government and/or the state of California.

**Urban** – Usually refers to areas with population of 5,000 or greater.

**Vanpool:** A ridesharing prearrangement using vans or small buses providing round-trip transportation between the participants' prearranged boarding points and a common and regular destination.

**Variable operating cost** – See *Operating cost*.

**Vehicle Inventory and Use Survey** – See *Truck Inventory and Use Survey*.

**Vehicle-miles traveled (vmt)** – One vehicle traveling the distance of one mile. Total vehicle miles, thus, is the total mileage traveled by all vehicles.

**Volatile organic compounds (VOCs)** – Organic compounds that participate in atmospheric photochemical reactions.

**Waterborne Commerce** –

**Coastwise:** Domestic traffic receiving a carriage over the ocean, or the Gulf of Mexico. Traffic between Great Lakes ports and seacoast ports, when having a carriage over the ocean, is also termed Coastwise.

**Domestic:** Includes coastwise, lakewise, and internal waterborne movements.

**Foreign:** Waterborne import, export, and in-transit traffic between the United States, Puerto Rico and the Virgin Islands and any foreign country.

**Internal:** Vessel movements (origin and destination) which take place solely on inland waterways. An inland waterway is one geographically located within the boundaries of the contiguous 48 states or within the boundaries of the State of Alaska.

**Lakewise:** Waterborne traffic between the United States ports on the Great Lakes System. The Great Lakes System is treated as a separate waterway system rather than as a part of the inland waterway system. In comparing historical data for the Great Lakes System, one should note that prior to calendar year 1990, marine products, sand and gravel being moved from the Great Lakes to Great Lake destinations were classified as local traffic. From 1990-on, these activities are classified as lakewise traffic.

**Well-to-wheel** – A life cycle analysis used in transportation to consider the entire energy cycle for a given mode, rather than just tailpipe emissions. The analysis starts at the oil well and ends with the turning wheels of the vehicle.

**Zero-emission vehicle** – Any vehicle certified to the zero emission standards which are set by the Federal government and/or the state of California. These standards apply to the vehicle emissions only.



**TITLE INDEX**



|  |       |
|--|-------|
| Acquisitions   |       |
| Federal Fleet Vehicle Acquisitions by Fuel Type, FY 2002–2010 .....  | 7–6   |
| Advanced   |       |
| Alternative Fuel and Advanced Technology Vehicles and Characteristics.....   | 6–1   |
| Federal and State Advanced Technology Incentives, 2011 .....   | 10–13 |
| Age  |       |
| Cars in Operation and Vehicle Travel by Age, 1970 and 2001 .....   | 3–11  |
| Trucks in Operation and Vehicle Travel by Age, 1970 and 2001 .....   | 3–12  |
| U.S. Average Vehicle Age, 1995–2009 .....  | 3–13  |
| Average Annual Miles per Household Vehicle by Vehicle Age .....  | 8–12  |
| Share of Vehicles by Annual Miles of Travel and Vehicle Age, 2009 NHTS .....   | 8–15  |
| Daily and Annual Vehicle Miles of Travel and Average Age for Each Vehicle<br>in a Household, 2009 NHTS .....                             | 8–17  |
| Agency   |       |
| Federal Government Vehicles by Agency, FY 2010.....  | 7–7   |
| Air  |       |
| Air Conditioning (SC03) Driving Cycle .....  | 4–32  |
| Summary Statistics for U.S. Domestic and International Certificated Route<br>Air Carriers (Combined Totals), 1970–2009 .....             | 9–3   |
| Criteria Air Pollutants .....  | 12–1  |
| Total National Emissions of the Criteria Air Pollutants by Sector, 2008.....   | 12–2  |
| Aircraft   |       |
| Aircraft – Exhaust Emission Standards .....  | 12–22 |
| Alternative  |       |
| Alternative Fuel and Oxygenate Consumption, 2003–2009 .....  | 2–5   |
| Alternative Fuel and Advanced Technology Vehicles and Characteristics.....   | 6–1   |
| Estimates of Alternative Fuel Vehicles in Use, 1995–2009 .....   | 6–3   |
| Alternative Fuel Transit Vehicles, 2009.....   | 6–4   |
| Alternative Fuel Vehicles Available by Manufacturer, Model Year 2011 .....   | 6–5   |
| Number of Alternative Refuel Sites by State and Fuel Type, 2011 .....  | 6–8   |
| Properties of Conventional and Alternative Fuels.....  | 6–11  |
| Federal and State Alternative Fuel Incentives, 2011 .....  | 10–12 |
| Amtrak   |       |
| Summary Statistics for the National Railroad Passenger Corporation<br>(Amtrak), 1971–2009.....   | 9–11  |
| Annual   |       |
| Average Annual Vehicle-Miles of Travel for Business Fleet Vehicles, 2009.....  | 7–3   |
| Average Annual Expenditures of Households by Income, 2009.....   | 8–4   |
| Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per<br>Household 1969, 1977, 1983, 1990, 1995 NPTS and 2001, 2009 NHTS ..... | 8–7   |
| Average Annual Miles per Household Vehicle by Vehicle Age.....   | 8–12  |
| Self-Reported vs. Odometer Average Annual Miles, 1995 NPTS and<br>2001 NHTS .....  | 8–13  |
| Share of Vehicles by Annual Miles of Travel and Vehicle Age, 2009 NHTS .....   | 8–15  |

## Annual (continued)

|  |       |
|--|-------|
| Daily and Annual Vehicle Miles of Travel and Average Age for Each Vehicle<br>in a Household, 2009 NHTS .....                 | 8-17  |
| Annual Vehicle Miles of Travel for Each Vehicle in a Household, 2009 NHTS.....   | 8-18  |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import Cars<br>by Size Class, Model Years 1975-2010 .....         | 11-13 |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import<br>Light Trucks by Size Class, Model Years 1975-2010 ..... | 11-14 |
| Average Annual Carbon Footprint by Vehicle Classification, 1975 and 2010 .....   | 11-15 |

## Appendix

|  |     |
|--|-----|
| Appendix A. Sources & Methodologies..... | A-1 |
| Appendix B. Conversions.....             | B-1 |
| Appendix C. Maps.....                    | C-1 |

## Attributes

|                                |      |
|--------------------------------|------|
| Driving Cycle Attributes ..... | 4-30 |
|--------------------------------|------|

## Available

|   |     |
|---|-----|
| Alternative Fuel Vehicles Available by Manufacturer, Model Year 2011..... | 6-5 |
| Hybrid Electric Vehicles Available by Manufacturer, Model Year 2011 ..... | 6-7 |

## Average

|  |       |
|--|-------|
| U.S. Average Vehicle Age, 1995-2009 .....  | 3-13  |
| Average Material Consumption for a Light Vehicle, Model Years 1995, 2000,<br>and 2009.....   | 4-16  |
| Car Corporate Average Fuel Economy (CAFE) Standards versus<br>Sales-Weighted Fuel Economy Estimates, 1978-2011 .....                     | 4-21  |
| Light Truck Corporate Average Fuel Economy (CAFE) Standards versus<br>Sales-Weighted Fuel Economy Estimates, 1978-2011 .....             | 4-22  |
| Corporate Average Fuel Economy (CAFE) Fines Collected, 1983-2009 .....   | 4-23  |
| Average Length of Time Business Fleet Vehicles are in Service, 2009 .....  | 7-3   |
| Average Annual Vehicle-Miles of Travel for Business Fleet Vehicles, 2009.....  | 7-3   |
| Average Miles per Domestic Federal Vehicle by Vehicle Type, 2010 .....   | 7-4   |
| Average Annual Expenditures of Households by Income, 2009.....   | 8-4   |
| Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per<br>Household 1969, 1977, 1983, 1990, 1995 NPTS and 2001, 2009 NHTS ..... | 8-7   |
| Average Number of Vehicles and Vehicle Travel per Household,<br>1990 NPTS and 2001 and 2009 NHTS.....                                    | 8-8   |
| Average Vehicle Occupancy by Vehicle Type, 1995 NPTS and<br>2009 NHTS .....  | 8-10  |
| Average Vehicle Occupancy by Trip Purpose, 1977 NPTS and<br>2009 NHTS .....  | 8-11  |
| Average Annual Miles per Household Vehicle by Vehicle Age.....   | 8-12  |
| Self-Reported vs. Odometer Average Annual Miles, 1995 NPTS and<br>2001 NHTS .....  | 8-13  |
| Average Daily Miles Driven (per Driver), 2009 NHTS .....   | 8-16  |
| Daily and Annual Vehicle Miles of Travel and Average Age for Each Vehicle<br>in a Household, 2009 NHTS .....                             | 8-17  |
| Average Price of a New Car, 1906-2009 .....  | 10-14 |
| Average Price of a New Car (Domestic and Import), 1970-2009 .....  | 10-15 |
| Average Annual Carbon Footprint by Vehicle Classification, 1975 and 2010 .....   | 11-15 |

|  |       |
|--|-------|
| Aviation   |       |
| Summary Statistics for General Aviation, 1970–2009 .....   | 9–4   |
| Refiner Sales Prices for Aviation Gasoline and Jet Fuel, 1978–2010 .....   | 10–10 |
| Axle   |       |
| Distribution of Five-Axle Tractor-Trailers by On-Road Vehicle Weight, 2008 .....   | 5–20  |
| Barrel   |       |
| Refinery Yield of Petroleum Products From a Barrel of Crude Oil, 1978–2010 .....   | 1–13  |
| Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978–2010 .....   | 10–7  |
| Bicycle  |       |
| Bicycle Sales, 1981–2009 .....   | 8–22  |
| Bike   |       |
| Walk and Bike Trips by Trip Purpose, 2009 NHTS .....   | 8–23  |
| Boat   |       |
| Recreational Boat Energy Use, 1970–2009 .....  | 9–7   |
| Bus  |       |
| Truck and Bus Registrations for Selected Countries, 1960–2009 .....  | 3–3   |
| Buses  |       |
| Summary Statistics on Transit Buses and Trolleybuses, 1994–2009 .....  | 5–24  |
| Heavy-Duty Highway Compression-Ignition Engines and Urban Buses –<br>Exhaust Emission Standards .....                        | 12–16 |
| Business   |       |
| Average Length of Time Business Fleet Vehicles are in Service, 2009 .....  | 7–3   |
| Average Annual Vehicle-Miles of Travel for Business Fleet Vehicles, 2009 .....   | 7–3   |
| CAFE   |       |
| Car Corporate Average Fuel Economy (CAFE) Standards versus<br>Sales-Weighted Fuel Economy Estimates, 1978–2011 .....         | 4–21  |
| Light Truck Corporate Average Fuel Economy (CAFE) Standards versus<br>Sales-Weighted Fuel Economy Estimates, 1978–2011 ..... | 4–22  |
| Corporate Average Fuel Economy (CAFE) Fines Collected, 1983–2009 .....   | 4–23  |
| California   |       |
| California Car, Light Truck and Medium Truck Emission Certification<br>Standards .....                                       | 12–21 |
| Capita   |       |
| Vehicles and Vehicle-Miles per Capita, 1950–2009 .....   | 8–3   |
| Car  |       |
| Car Registrations for Selected Countries, 1960–2009 .....  | 3–2   |
| Car Scrappage and Survival Rates, 1970, 1980 and 1990 Model Years .....  | 3–15  |
| Car and Light Truck Survivability Rates and Lifetime Miles .....   | 3–18  |
| New Retail Car Sales in the United States, 1970–2010 .....   | 4–5   |

## Car (continued)

|  |       |
|--|-------|
| Car Corporate Average Fuel Economy (CAFE) Standards versus<br>Sales-Weighted Fuel Economy Estimates, 1978–2011 ..... | 4–21  |
| Average Price of a New Car, 1906–2009 .....  | 10–14 |
| Average Price of a New Car (Domestic and Import), 1970–2009 .....  | 10–15 |
| Car Operating Cost per Mile, 1985–2010 .....   | 10–16 |
| Fixed Car Operating Costs per Year, 1975–2010.....   | 10–17 |
| California Car, Light Truck and Medium Truck Emission Certification<br>Standards.....                                | 12–21 |

## Carbon

|  |       |
|--|-------|
| Fuel Economy and Carbon Dioxide Emissions Standards, MY 2012–2016.....   | 4–19  |
| Fuel Economy and Carbon Dioxide Targets for Model Year 2016.....   | 4–20  |
| World Carbon Dioxide Emissions, 1990 and 2007 .....  | 11–2  |
| Numerical Estimates of Global Warming Potentials Compared with Carbon Dioxide .....  | 11–3  |
| U.S. Carbon Emissions from Fossil Energy Consumption by End-Use<br>Sector, 1990–2009 .....                                   | 11–6  |
| U.S. Carbon Emissions from Energy Use in the Transportation<br>Sector, 1990–2009 .....                                       | 11–7  |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import Cars<br>by Size Class, Model Years 1975–2010 .....         | 11–13 |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import<br>Light Trucks by Size Class, Model Years 1975–2010 ..... | 11–14 |
| Average Annual Carbon Footprint by Vehicle Classification, 1975 and 2010 .....   | 11–15 |
| Carbon Dioxide Emissions from a Gallon of Fuel .....   | 11–16 |
| Total National Emissions of Carbon Monoxide, 1970–2008.....  | 12–3  |
| Emissions of Carbon Monoxide from Highway Vehicles, 1970–2005.....   | 12–4  |

## Carriers

|  |     |
|--|-----|
| Summary Statistics for U.S. Domestic and International Certificated Route<br>Air Carriers (Combined Totals), 1970–2009 ..... | 9–3 |
|--|-----|

## Cars

|   |       |
|---|-------|
| U.S. Cars and Trucks in Use, 1970–2009 .....  | 3–5   |
| Cars in Operation and Vehicle Travel by Age, 1970 and 2001 .....  | 3–11  |
| Summary Statistics for Cars, 1970–2009 .....  | 4–2   |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New<br>Domestic and Import Cars, Selected Model Years 1975–2010 ..... | 4–7   |
| Sales-Weighted Engine Size of New Domestic and Import Cars<br>by Size Class, Model Years 1975–2010 .....                                | 4–12  |
| Sales-Weighted Curb Weight of New Domestic and Import Cars<br>by Size Class, Model Years 1975–2010 .....                                | 4–14  |
| Sales-Weighted Interior Space of New Domestic and Import Cars by Size Class,<br>Model Years 1977–2010.....                              | 4–15  |
| The Gas Guzzler Tax on New Cars .....   | 4–24  |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import Cars<br>by Size Class, Model Years 1975–2010 .....                    | 11–13 |

## Census

|   |     |
|---|-----|
| Household Vehicle Ownership, 1960–2009 Census ..... | 8–5 |
|---|-----|

## Certificated

|  |     |
|--|-----|
| Summary Statistics for U.S. Domestic and International Certificated Route<br>Air Carriers (Combined Totals), 1970–2009 ..... | 9–3 |
|--|-----|

## Certification

|  |       |
|--|-------|
| California Car, Light Truck and Medium Truck Emission Certification Standards..... | 12-21 |
|--|-------|

## Characteristics

|   |      |
|---|------|
| Light Vehicles and Characteristics.....   | 4-1  |
| Heavy Vehicles and Characteristics.....   | 5-1  |
| Alternative Fuel and Advanced Technology Vehicles and Characteristics.....                | 6-1  |
| Fleet Vehicles and Characteristics.....   | 7-1  |
| Household Vehicles and Characteristics.....   | 8-1  |
| Characteristics of U.S. Daily per Vehicle Driving vs. Dwelling Unit Type and Density..... | 8-20 |
| Housing Unit Characteristics, 2007.....   | 8-20 |
| Long-Distance Trip Characteristics, 2001 NHTS.....  | 8-25 |

## Cities

|                              |     |
|------------------------------|-----|
| Clean Cities Coalitions..... | 6-9 |
|------------------------------|-----|

## City

|                                  |      |
|----------------------------------|------|
| City Driving Cycle.....          | 4-31 |
| New York City Driving Cycle..... | 4-34 |

## Class

|  |       |
|--|-------|
| Light Vehicle Market Shares by Size Class, Model Years 1975–2010.....  | 4-10  |
| Sales-Weighted Engine Size of New Domestic and Import Cars by Size Class, Model Years 1975–2010.....                     | 4-12  |
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class, Model Years 1975–2010.....             | 4-13  |
| Sales-Weighted Curb Weight of New Domestic and Import Cars by Size Class, Model Years 1975–2010.....                     | 4-14  |
| Sales-Weighted Interior Space of New Domestic and Import Cars by Size Class, Model Years 1977–2010.....                  | 4-15  |
| Truck Statistics by Gross Vehicle Weight Class, 2002.....  | 5-6   |
| Truck Harmonic Mean Fuel Economy by Size Class, 1992, 1997, and 2002.....  | 5-6   |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import Cars by Size Class, Model Years 1975-2010.....         | 11-13 |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import Light Trucks by Size Class, Model Years 1975-2010..... | 11-14 |

## Class 1

|  |     |
|--|-----|
| Summary Statistics on Class 1, Class 2a, and Class 2b Light Trucks.....                      | 4-4 |
| Sales Estimates of Class 1, Class 2a, and Class 2b Light Trucks, 1989–1999.....              | 4-4 |
| Class I Railroad Freight Systems in the United States Ranked by Revenue Ton–Miles, 2009..... | 9-8 |
| Summary Statistics for Class I Freight Railroads, 1970–2009.....                             | 9-9 |

## Class 2a

|   |     |
|---|-----|
| Summary Statistics on Class 1, Class 2a, and Class 2b Light Trucks.....         | 4-4 |
| Sales Estimates of Class 1, Class 2a, and Class 2b Light Trucks, 1989–1999..... | 4-4 |

## Class 2b

|   |     |
|---|-----|
| Summary Statistics on Class 1, Class 2a, and Class 2b Light Trucks.....         | 4-4 |
| Sales Estimates of Class 1, Class 2a, and Class 2b Light Trucks, 1989–1999..... | 4-4 |

|   |       |
|---|-------|
| Class 8   |       |
| Effect of Terrain on Class 8 Truck Fuel Economy.....  | 5–14  |
| Fuel Economy for Class 8 Trucks as Function of Speed and Tractor-Trailer<br>Tire Combination.....   | 5–15  |
| Class 8 Truck Fuel Economy as a Function of Speed and Tractor-Trailer Tire<br>Combination and Percentage of Total Distance Traveled as a Function<br>of Speed ..... | 5–16  |
| Class 8 Truck Percent of Total Fuel Consumed as a Function of Speed and<br>Tractor-Trailer Tire Combination.....  | 5–17  |
| Class 8 Truck Weight by Component .....   | 5–18  |
| Classification  |       |
| Average Annual Carbon Footprint by Vehicle Classification, 1975 and 2010 .....  | 11–15 |
| Clean   |       |
| Clean Cities Coalitions .....   | 6–9   |
| Coalitions  |       |
| Clean Cities Coalitions .....   | 6–9   |
| Cold  |       |
| Cold Temperature (Cold FTP) Driving Cycle.....  | 4–32  |
| Collected   |       |
| Corporate Average Fuel Economy (CAFE) Fines Collected, 1983–2009 .....  | 4–23  |
| Combination   |       |
| Summary Statistics for Combination Trucks, 1970–2009.....   | 5–3   |
| Fuel Economy for Class 8 Trucks as Function of Speed and Tractor-Trailer<br>Tire Combination.....   | 5–15  |
| Class 8 Truck Fuel Economy as a Function of Speed and Tractor-Trailer Tire<br>Combination and Percentage of Total Distance Traveled as a Function<br>of Speed ..... | 5–16  |
| Class 8 Truck Percent of Total Fuel Consumed as a Function of Speed and<br>Tractor-Trailer Tire Combination.....  | 5–17  |
| Combined  |       |
| Summary Statistics for U.S. Domestic and International Certificated Route<br>Air Carriers (Combined Totals), 1970–2009 .....  | 9–3   |
| Commerce  |       |
| Tonnage Statistics for Domestic and International Waterborne<br>Commerce, 1970–2009 .....   | 9–5   |
| Summary Statistics for Domestic Waterborne Commerce, 1970–2009 .....  | 9–6   |
| Commodity   |       |
| Growth of Freight in the United States: Comparison of the 1997, 2002 and 2007 Commodity<br>Flow Surveys .....   | 5–22  |
| Growth of Freight Miles in the United States: Comparison of the 1997, 2002 and<br>2007 Commodity Flow Surveys .....   | 5–23  |
| Commute   |       |
| Workers by Commute Time, 1990 and 2000 Census.....  | 8–21  |



|   |       |
|---|-------|
| Commuter  |       |
| Energy Intensity of Commuter Rail Systems, 2009 .....   | 2–18  |
| Summary Statistics for Commuter Rail Operations, 1984–2009 .....  | 9–12  |
| Compared  |       |
| Vehicles per Thousand People: U.S. (Over Time) Compared to Other<br>Countries (in 1999 and 2009) .....              | 3–6   |
| Numerical Estimates of Global Warming Potentials Compared with Carbon Dioxide .....                                 | 11–3  |
| Comparison  |       |
| Comparison of U.S., European, and Japanese Driving Cycles.....  | 4–36  |
| Growth of Freight in the United States: Comparison of the 1997, 2002 and 2007 Commodity<br>Flow Surveys .....       | 5–22  |
| Growth of Freight Miles in the United States: Comparison of the 1997, 2002 and<br>2007 Commodity Flow Surveys ..... | 5–23  |
| Component   |       |
| Class 8 Truck Weight by Component .....   | 5–18  |
| Compounds   |       |
| Total National Emissions of Volatile Organic Compounds, 1970–2008 .....   | 12–7  |
| Emissions of Volatile Organic Compounds from Highway Vehicles, 1970–2005 .....                                      | 12–8  |
| Compression   |       |
| Heavy-Duty Highway Compression-Ignition Engines and Urban Buses –<br>Exhaust Emission Standards .....               | 12–16 |
| Heavy-Duty Highway Compression Ignition and Spark-Ignition Engines –<br>Evaporative Emission Standards.....         | 12–20 |
| Nonroad Compression-Ignition Engines – Exhaust Emission Standards.....  | 12–23 |
| Marine Compression-Ignition (CI) Engines – Exhaust Emission<br>Standards.....                                       | 12–28 |
| Conditioning  |       |
| Air Conditioning (SC03) Driving Cycle .....   | 4–32  |
| Consumed  |       |
| Class 8 Truck Percent of Total Fuel Consumed as a Function of Speed and<br>Tractor-Trailer Tire Combination .....   | 5–17  |
| Fuel Consumed by Federal Government Fleets, FY 2000–2010 .....  | 7–6   |
| Consumer  |       |
| Consumer Price Indices, 1970–2010.....  | 10–18 |
| Consumption   |       |
| World Petroleum Consumption, 1960–2010 .....  | 1–5   |
| World Oil Reserves, Production and Consumption, 2009.....   | 1–6   |
| World Natural Gas Reserves, Production and Consumption, 2009 .....  | 1–7   |
| Petroleum Production and Consumption and Some Important Percent<br>Shares, 1950–2010.....                           | 1–15  |
| United States Petroleum Production and Consumption – All Sectors,<br>1973–2035 .....                                | 1–16  |
| United States Petroleum Production, Transportation and Consumption,<br>1970–2035 .....                              | 1–17  |

|  |       |
|--|-------|
| Consumption (continued)  |       |
| Consumption of Petroleum by End-Use Sector, 1973–2010.....   | 1–18  |
| Highway Transportation Petroleum Consumption by Mode, 1970–2010.....   | 1–19  |
| Nonhighway Transportation Petroleum Consumption by Mode, 1970–2009.....  | 1–20  |
| World Consumption of Primary Energy, 2008.....   | 2–2   |
| U. S. Consumption of Total Energy by End-Use Sector, 1973–2010.....  | 2–3   |
| Distribution of Energy Consumption by Source, 1973 and 2010.....   | 2–4   |
| Alternative Fuel and Oxygenate Consumption, 2003–2009 .....  | 2–5   |
| Ethanol Consumption, 1995–2009 .....   | 2–6   |
| Domestic Consumption of Transportation Energy by Mode and<br>Fuel Type, 2009 .....   | 2–7   |
| Highway Transportation Energy Consumption by Mode, 1970–2009.....  | 2–9   |
| Nonhighway Transportation Energy Consumption by Mode, 1970–2009.....   | 2–10  |
| Off-highway Transportation-related Fuel Consumption from the NonRoad Model, 2009.....  | 2–11  |
| Fuel Consumption from Lawn and Garden Equipment, 2009.....   | 2–12  |
| Average Material Consumption for a Light Vehicle, Model Years 1995, 2000,<br>and 2009.....                                   | 4–16  |
| Personal Consumption Expenditures, 1970–2010.....  | 10–18 |
| U.S. Carbon Emissions from Fossil Energy Consumption by End-Use<br>Sector, 1990–2009 .....                                   | 11–6  |
| Conventional   |       |
| Conventional Refueling Stations, 1993–2009.....  | 4–18  |
| Properties of Conventional and Alternative Fuels.....  | 6–11  |
| Conversions  |       |
| Appendix B. Conversions.....   | B–1   |
| Corporate  |       |
| Car Corporate Average Fuel Economy (CAFE) Standards versus<br>Sales-Weighted Fuel Economy Estimates, 1978–2011 .....         | 4–21  |
| Light Truck Corporate Average Fuel Economy (CAFE) Standards versus<br>Sales-Weighted Fuel Economy Estimates, 1978–2011 ..... | 4–22  |
| Corporate Average Fuel Economy (CAFE) Fines Collected, 1983–2009 .....   | 4–23  |
| Corporation  |       |
| Summary Statistics for the National Railroad Passenger Corporation<br>(Amtrak), 1971–2009 .....                              | 9–11  |
| Cost   |       |
| Car Operating Cost per Mile, 1985–2010 .....   | 10–16 |
| Costs  |       |
| Costs of Oil Dependence to the U.S. Economy, 1970–2010.....  | 1–10  |
| Fixed Car Operating Costs per Year, 1975–2010.....   | 10–17 |
| Countries  |       |
| Car Registrations for Selected Countries, 1960–2009.....   | 3–2   |
| Truck and Bus Registrations for Selected Countries, 1960–2009.....   | 3–3   |
| Vehicles per Thousand People: U.S. (Over Time) Compared to Other<br>Countries (in 1999 and 2009) .....                       | 3–6   |

|  |      |
|--|------|
| Countries (continued)  |      |
| Vehicles per Thousand People in Other Countries, 1999 and 2009 .....   | 3-8  |
| Gasoline Prices for Selected Countries, 1990-2010 .....  | 10-3 |
| Diesel Fuel Prices for Selected Countries, 1998-2010 .....   | 10-4 |
| Gasoline Prices for Selected Countries, 1990 and 2010.....   | 10-5 |
| Diesel Prices for Selected Countries, 1990 and 2010.....   | 10-6 |
| Criteria   |      |
| Criteria Air Pollutants .....  | 12-1 |
| Total National Emissions of the Criteria Air Pollutants by Sector, 2008.....                                 | 12-2 |
| Crude  |      |
| World Crude Oil Production, 1960-2010 .....  | 1-3  |
| U.S. Refinery Input of Crude Oil and Petroleum Products, 1987-2009 .....                                     | 1-12 |
| Refinery Yield of Petroleum Products from a Barrel of Crude Oil, 1978-2010.....                              | 1-13 |
| Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978-2010.....                                    | 10-7 |
| Curb   |      |
| Sales-Weighted Curb Weight of New Domestic and Import Cars<br>by Size Class, Model Years 1975-2010 .....     | 4-14 |
| Cycle  |      |
| Driving Cycle Attributes .....   | 4-30 |
| City Driving Cycle .....   | 4-31 |
| Highway Driving Cycle.....   | 4-31 |
| Air Conditioning (SC03) Driving Cycle .....  | 4-32 |
| Cold Temperature (Cold FTP) Driving Cycle.....   | 4-32 |
| High Speed (US06) Driving Cycle.....   | 4-33 |
| New York City Driving Cycle.....   | 4-34 |
| Representative Number Five Driving Cycle .....   | 4-35 |
| Cycles   |      |
| Projected Fuel Economies from U.S., European, and Japanese Driving Cycles.....                               | 4-35 |
| Comparison of U.S., European, and Japanese Driving Cycles.....   | 4-36 |
| Daily  |      |
| Average Daily Miles Driven (per Driver), 2009 NHTS .....   | 8-16 |
| Daily Vehicle Miles of Travel (per Vehicle) by Number of Vehicles in the<br>Household, 2009 NHTS.....        | 8-17 |
| Daily and Annual Vehicle Miles of Travel and Average Age for Each Vehicle<br>in a Household, 2009 NHTS ..... | 8-17 |
| Daily Vehicle Miles of Travel for Each Vehicle in a Household, 2009 NHTS .....                               | 8-18 |
| Characteristics of U.S. Daily per Vehicle Driving vs. Dwelling Unit Type<br>and Density .....                | 8-20 |
| Dealerships  |      |
| New Light Vehicle Dealerships and Sales, 1970-2009 .....   | 4-17 |
| Definition   |      |
| Definition of Wagons in Model Year 2010.....   | 4-8  |
| Demand   |      |
| Summary Statistics on Demand Response Vehicles, 1994-2009 .....  | 4-37 |

## Demographic

|  |     |
|--|-----|
| Demographic Statistics from the 1969, 1977, 1983, 1990, 1995 NPTS<br>and 2001, 2009 NHTS ..... | 8-6 |
|--|-----|

## Density

|   |      |
|---|------|
| Characteristics of U.S. Daily per Vehicle Driving vs. Dwelling Unit Type<br>and Density ..... | 8-20 |
|---|------|

## Dependence

|   |      |
|---|------|
| Costs of Oil Dependence to the U.S. Economy, 1970-2010..... | 1-10 |
|---|------|

## Diesel

|  |       |
|--|-------|
| Highway Usage of Gasoline and Diesel, 1973-2009 .....                                | 2-13  |
| Diesel Fuel Prices for Selected Countries, 1998-2010 .....                           | 10-4  |
| Diesel Prices for Selected Countries, 1990 and 2010.....                             | 10-6  |
| Refiner Sales Prices for Propane and No. 2 Diesel, 1978-2010 .....                   | 10-9  |
| Highway, Nonroad, Locomotive, and Marine (NRLM) Diesel Fuel<br>Sulfur Standards..... | 12-37 |

## Dioxide

|   |       |
|---|-------|
| Fuel Economy and Carbon Dioxide Emissions Standards, MY 2012-2016.....              | 4-19  |
| Fuel Economy and Carbon Dioxide Targets for Model Year 2016.....                    | 4-20  |
| World Carbon Dioxide Emissions, 1990 and 2007 .....                                 | 11-2  |
| Numerical Estimates of Global Warming Potentials Compared with Carbon Dioxide ..... | 11-3  |
| Carbon Dioxide Emissions from a Gallon of Fuel .....                                | 11-16 |

## Distance

|   |      |
|---|------|
| Class 8 Truck Fuel Economy as a Function of Speed and Tractor-Trailer Tire<br>Combination and Percentage of Total Distance Traveled as a Function<br>of Speed ..... | 5-16 |
| Share of Vehicle Trips by Trip Distance, 2009 NHTS.....   | 8-14 |
| Share of Vehicle Trips to Work by Trip Distance, 2009 NHTS .....  | 8-14 |
| Long-Distance Trip Characteristics, 2001 NHTS .....   | 8-25 |

## Distribution

|   |      |
|---|------|
| Distribution of Energy Consumption by Source, 1973 and 2010.....                                    | 2-4  |
| Distribution of Trucks over 26,000 lbs. Less than Two Years Old by Vehicle-<br>Miles Traveled ..... | 5-11 |
| Distribution of Five-Axle Tractor-Trailers by On-Road Vehicle Weight, 2008 .....                    | 5-20 |

## Domestic

|   |      |
|---|------|
| Domestic Consumption of Transportation Energy by Mode and<br>Fuel Type, 2009 .....  | 2-7  |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New<br>Domestic and Import Cars, Selected Model Years 1975-2010 ..... | 4-7  |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New<br>Domestic and Import Light Trucks, Model Years 1975-2010 .....  | 4-9  |
| Sales-Weighted Engine Size of New Domestic and Import Cars<br>by Size Class, Model Years 1975-2010 .....                                | 4-12 |
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks<br>by Size Class, Model Years 1975-2010 .....                        | 4-13 |
| Sales-Weighted Curb Weight of New Domestic and Import Cars<br>by Size Class, Model Years 1975-2010 .....                                | 4-14 |

## Domestic (continued)

|  |       |
|--|-------|
| Sales-Weighted Interior Space of New Domestic and Import Cars by Size Class,<br>Model Years 1977–2010 .....                  | 4–15  |
| Average Miles per Domestic Federal Vehicle by Vehicle Type, 2010 .....   | 7–4   |
| Summary Statistics for U.S. Domestic and International Certificated Route<br>Air Carriers (Combined Totals), 1970–2009 ..... | 9–3   |
| Tonnage Statistics for Domestic and International Waterborne<br>Commerce, 1970–2009 .....                                    | 9–5   |
| Summary Statistics for Domestic Waterborne Commerce, 1970–2009 .....   | 9–6   |
| Average Price of a New Car (Domestic and Import), 1970–2009 .....  | 10–15 |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import Cars<br>by Size Class, Model Years 1975–2010 .....         | 11–13 |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import<br>Light Trucks by Size Class, Model Years 1975–2010 ..... | 11–14 |

## Driven

|  |      |
|--|------|
| Average Daily Miles Driven (per Driver), 2009 NHTS ..... | 8–16 |
|--|------|

## Driver

|  |      |
|--|------|
| Average Daily Miles Driven (per Driver), 2009 NHTS ..... | 8–16 |
|--|------|

## Driving

|   |      |
|---|------|
| Driving Cycle Attributes .....  | 4–30 |
| City Driving Cycle .....  | 4–31 |
| Highway Driving Cycle .....   | 4–31 |
| Air Conditioning (SC03) Driving Cycle .....   | 4–32 |
| Cold Temperature (Cold FTP) Driving Cycle .....   | 4–32 |
| High Speed (US06) Driving Cycle .....   | 4–33 |
| New York City Driving Cycle .....   | 4–34 |
| Representative Number Five Driving Cycle .....  | 4–34 |
| Projected Fuel Economies from U.S., European, and Japanese Driving Cycles .....               | 4–35 |
| Comparison of U.S., European, and Japanese Driving Cycles .....                               | 4–36 |
| Characteristics of U.S. Daily per Vehicle Driving vs. Dwelling Unit Type<br>and Density ..... | 8–20 |

## Dwelling

|   |      |
|---|------|
| Characteristics of U.S. Daily per Vehicle Driving vs. Dwelling Unit Type<br>and Density ..... | 8–20 |
|---|------|

## Economic

|  |     |
|--|-----|
| Oil Price and Economic Growth, 1970–2010 ..... | 1–9 |
|--|-----|

## Economies

|   |      |
|---|------|
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New<br>Domestic and Import Cars, Selected Model Years 1975–2010 ..... | 4–7  |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New<br>Domestic and Import Light Trucks, Model Years 1975–2010 .....  | 4–9  |
| Projected Fuel Economies from U.S., European, and Japanese Driving Cycles .....   | 4–35 |

## Economy

|   |      |
|---|------|
| Costs of Oil Dependence to the U.S. Economy, 1970–2010 .....            | 1–10 |
| Fuel Economy and Carbon Dioxide Emissions Standards, MY 2012–2016 ..... | 4–19 |
| Fuel Economy and Carbon Dioxide Targets for Model Year 2016 .....       | 4–20 |

## Economy (continued)

|   |      |
|---|------|
| Car Corporate Average Fuel Economy (CAFE) Standards versus<br>Sales-Weighted Fuel Economy Estimates, 1978–2011 .....  | 4–21 |
| Light Truck Corporate Average Fuel Economy (CAFE) Standards versus<br>Sales-Weighted Fuel Economy Estimates, 1978–2011 .....  | 4–22 |
| Corporate Average Fuel Economy (CAFE) Fines Collected, 1983–2009 .....  | 4–23 |
| Fuel Economy by Speed, PSAT Model Results .....   | 4–26 |
| Fuel Economy by Speed, 1973, 1984, and 1997 Studies .....   | 4–28 |
| Steady Speed Fuel Economy for Vehicles Tested in the 1997 Study.....  | 4–29 |
| Truck Harmonic Mean Fuel Economy by Size Class, 1992, 1997, and 2002 .....  | 5–6  |
| Effect of Terrain on Class 8 Truck Fuel Economy.....  | 5–14 |
| Fuel Economy for Class 8 Trucks as Function of Speed and Tractor-Trailer<br>Tire Combination.....   | 5–15 |
| Class 8 Truck Fuel Economy as a Function of Speed and Tractor-Trailer Tire<br>Combination and Percentage of Total Distance Traveled as a Function<br>of Speed ..... | 5–16 |
| Transportation and the Economy.....   | 10–1 |

## Effect

|  |      |
|--|------|
| Effect of Terrain on Class 8 Truck Fuel Economy..... | 5–14 |
|--|------|

## Electric

|   |     |
|---|-----|
| Hybrid Electric Vehicles Available by Manufacturer, Model Year 2011 ..... | 6–7 |
|---|-----|

## Electronic

|   |      |
|---|------|
| Share of Heavy Trucks with Selected Electronic Features, 2002 ..... | 5–12 |
|---|------|

## Emission

|   |       |
|---|-------|
| Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger<br>Vehicle – Tier 2 Exhaust Emission Standards .....    | 12–14 |
| Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger<br>Vehicle – Tier 2 Evaporative Emission Standards..... | 12–15 |
| Heavy-Duty Highway Compression-Ignition Engines and Urban Buses –<br>Exhaust Emission Standards .....                   | 12–16 |
| Heavy-Duty Highway Spark-Ignition Engines – Exhaust Emission<br>Standards.....  | 12–18 |
| Heavy-Duty Highway Compression Ignition and Spark-Ignition Engines –<br>Evaporative Emission Standards.....             | 12–20 |
| California Car, Light Truck and Medium Truck Emission Certification<br>Standards.....                                   | 12–21 |
| Aircraft – Exhaust Emission Standards .....   | 12–22 |
| Nonroad Compression-Ignition Engines – Exhaust Emission Standards.....  | 12–23 |
| Nonroad Large Spark-Ignition Engines – Exhaust and Evaporative<br>Emission Standards.....                               | 12–25 |
| Locomotives – Exhaust Emission Standards.....   | 12–26 |
| Marine Compression-Ignition (CI) Engines – Exhaust Emission<br>Standards.....   | 12–28 |
| Marine Spark-Ignition Engines and Vessels – Exhaust Emission<br>Standards.....  | 12–32 |
| Nonroad Recreational Engines and Vehicles – Exhaust Emission<br>Standards .....   | 12–34 |

## Emissions

|  |       |
|--|-------|
| Fuel Economy and Carbon Dioxide Emissions Standards, MY 2012–2016.....                     | 4–19  |
| Greenhouse Gas Emissions .....   | 11–1  |
| World Carbon Dioxide Emissions, 1990 and 2007 .....  | 11–2  |
| Total U.S. Greenhouse Emissions by End-Use Sector, 2009 .....                              | 11–5  |
| U.S. Carbon Emissions from Fossil Energy Consumption by End-Use<br>Sector, 1990–2009 ..... | 11–6  |
| U.S. Carbon Emissions from Energy Use in the Transportation<br>Sector, 1990–2009 .....     | 11–7  |
| Transportation Greenhouse Gas Emissions by Mode, 1990 and 2009 .....                       | 11–8  |
| Well-to-Wheel Emissions for Various Fuels and Vehicle Technologies .....                   | 11–11 |
| Carbon Dioxide Emissions from a Gallon of Fuel .....                                       | 11–16 |
| Total National Emissions of the Criteria Air Pollutants by Sector, 2008.....               | 12–2  |
| Total National Emissions of Carbon Monoxide, 1970–2008 .....                               | 12–3  |
| Emissions of Carbon Monoxide from Highway Vehicles, 1970–2005.....                         | 12–4  |
| Total National Emissions of Nitrogen Oxides, 1970–2008.....                                | 12–5  |
| Emissions of Nitrogen Oxides from Highway Vehicles, 1970–2005.....                         | 12–6  |
| Total National Emissions of Volatile Organic Compounds, 1970–2008 .....                    | 12–7  |
| Emissions of Volatile Organic Compounds from Highway Vehicles, 1970–2005 .....             | 12–8  |
| Total National Emissions of Particulate Matter (PM-10), 1970–2008 .....                    | 12–9  |
| Emissions of Particulate Matter (PM-10) from Highway Vehicles, 1970–2005.....              | 12–10 |
| Total National Emissions of Particulate Matter (PM-2.5), 1990–2008.....                    | 12–11 |
| Emissions of Particulate Matter (PM-2.5) from Highway Vehicles, 1990–2005.....             | 12–12 |

## Employment

|   |       |
|---|-------|
| Transportation-related Employment, 2000 and 2010 .....                                      | 10–19 |
| U.S. Employment for Motor Vehicles and Motor Vehicle Parts<br>Manufacturing, 1990–2010..... | 10–20 |

## Empty

|   |      |
|---|------|
| Gross Vehicle Weight vs. Empty Vehicle Weight ..... | 5–19 |
|---|------|

## End-Use

|  |      |
|--|------|
| Consumption of Petroleum by End-Use Sector, 1973–2010.....                                 | 1–18 |
| U. S. Consumption of Total Energy by End-Use Sector, 1973–2010 .....                       | 2–3  |
| Total U.S. Greenhouse Emissions by End-Use Sector, 2009 .....                              | 11–5 |
| U.S. Carbon Emissions from Fossil Energy Consumption by End-Use<br>Sector, 1990–2009 ..... | 11–6 |

## Energy

|  |      |
|--|------|
| World Consumption of Primary Energy, 2008.....                                     | 2–2  |
| U. S. Consumption of Total Energy by End-Use Sector, 1973–2010 .....               | 2–3  |
| Distribution of Energy Consumption by Source, 1973 and 2010.....                   | 2–4  |
| Domestic Consumption of Transportation Energy by Mode and<br>Fuel Type, 2009 ..... | 2–7  |
| Transportation Energy Use by Mode, 2008–2009.....                                  | 2–8  |
| Highway Transportation Energy Consumption by Mode, 1970–2009.....                  | 2–9  |
| Nonhighway Transportation Energy Consumption by Mode, 1970–2009.....               | 2–10 |
| Passenger Travel and Energy Use, 2009 .....  | 2–14 |
| Energy Intensities of Highway Passenger Modes, 1970–2009 .....                     | 2–15 |
| Energy Intensities of Nonhighway Passenger Modes, 1970–2009 .....                  | 2–16 |
| Energy Intensity of Light Rail Transit Systems, 2009 .....                         | 2–17 |
| Energy Intensity of Heavy Rail Systems, 2009.....                                  | 2–18 |
| Energy Intensity of Commuter Rail Systems, 2009 .....                              | 2–18 |

## Energy (continued)

|  |      |
|--|------|
| Energy Intensities of Freight Modes, 1970–2009 .....                                       | 2–19 |
| Nonhighway Energy Use Shares, 1970–2009 .....  | 9–2  |
| Recreational Boat Energy Use, 1970–2009.....   | 9–7  |
| U.S. Carbon Emissions from Fossil Energy Consumption by End-Use<br>Sector, 1990–2009 ..... | 11–6 |
| U.S. Carbon Emissions from Energy Use in the Transportation<br>Sector, 1990–2009 .....     | 11–7 |

## Engine

|  |      |
|--|------|
| Sales-Weighted Engine Size of New Domestic and Import Cars<br>by Size Class, Model Years 1975–2010 .....         | 4–12 |
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks<br>by Size Class, Model Years 1975–2010 ..... | 4–13 |

## Engines

|   |       |
|---|-------|
| Heavy-Duty Highway Compression-Ignition Engines and Urban Buses –<br>Exhaust Emission Standards .....       | 12–16 |
| Heavy-Duty Highway Spark-Ignition Engines – Exhaust Emission<br>Standards.....                              | 12–18 |
| Heavy-Duty Highway Compression Ignition and Spark-Ignition Engines –<br>Evaporative Emission Standards..... | 12–20 |
| Nonroad Compression-Ignition Engines – Exhaust Emission Standards.....                                      | 12–23 |
| Nonroad Large Spark-Ignition Engines – Exhaust and Evaporative<br>Emission Standards.....                   | 12–25 |
| Marine Compression-Ignition (CI) Engines – Exhaust Emission<br>Standards.....                               | 12–28 |
| Marine Spark-Ignition Engines and Vessels – Exhaust Emission<br>Standards.....                              | 12–32 |
| Nonroad Recreational Engines and Vehicles – Exhaust Emission<br>Standards .....                             | 12–34 |

## Equipment

|  |      |
|--|------|
| Fuel Consumption from Lawn and Garden Equipment, 2009..... | 2–12 |
|--|------|

## Estimates

|  |      |
|--|------|
| Sales Estimates of Class 1, Class 2a, and Class 2b Light Trucks, 1989–1999.....  | 4–4  |
| Car Corporate Average Fuel Economy (CAFE) Standards versus<br>Sales-Weighted Fuel Economy Estimates, 1978–2011 .....         | 4–21 |
| Light Truck Corporate Average Fuel Economy (CAFE) Standards versus<br>Sales-Weighted Fuel Economy Estimates, 1978–2011 ..... | 4–22 |
| Estimates of Alternative Fuel Vehicles in Use, 1995–2009 .....   | 6–3  |
| Numerical Estimates of Global Warming Potentials Compared with Carbon Dioxide .....  | 11–3 |

## Ethanol

|                                      |     |
|--------------------------------------|-----|
| Ethanol Consumption, 1995–2009 ..... | 2–6 |
|--------------------------------------|-----|

## European

|  |      |
|--|------|
| Projected Fuel Economies from U.S., European, and Japanese Driving Cycles..... | 4–35 |
| Comparison of U.S., European, and Japanese Driving Cycles.....                 | 4–36 |



|  |       |
|--|-------|
| Evaporative  |       |
| Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger Vehicle – Tier 2 Evaporative Emission Standards..... | 12–15 |
| Heavy-Duty Highway Compression Ignition and Spark-Ignition Engines – Evaporative Emission Standards.....             | 12–20 |
| Nonroad Large Spark-Ignition Engines – Exhaust and Evaporative Emission Standards.....                               | 12–25 |
| Excise   |       |
| Federal Excise Taxes on Motor Fuels, 2009 .....  | 10–11 |
| Exemptions   |       |
| State Tax Exemptions for Gasohol, 2009.....  | 10–11 |
| Exhaust  |       |
| Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger Vehicle – Tier 2 Exhaust Emission Standards.....     | 12–14 |
| Heavy-Duty Highway Compression-Ignition Engines and Urban Buses – Exhaust Emission Standards .....                   | 12–16 |
| Heavy-Duty Highway Spark-Ignition Engines – Exhaust Emission Standards.....  | 12–18 |
| Aircraft – Exhaust Emission Standards.....   | 12–22 |
| Nonroad Compression-Ignition Engines – Exhaust Emission Standards.....   | 12–23 |
| Nonroad Large Spark-Ignition Engines – Exhaust and Evaporative Emission Standards.....                               | 12–25 |
| Locomotives – Exhaust Emission Standards.....  | 12–26 |
| Marine Compression-Ignition (CI) Engines – Exhaust Emission Standards.....   | 12–28 |
| Marine Spark-Ignition Engines and Vessels – Exhaust Emission Standards.....  | 12–32 |
| Nonroad Recreational Engines and Vehicles – Exhaust Emission Standards .....   | 12–34 |
| Expenditures   |       |
| Average Annual Expenditures of Households by Income, 2009.....   | 8–4   |
| Personal Consumption Expenditures, 1970–2010.....  | 10–18 |
| Exports  |       |
| United States Petroleum Production, Imports and Exports, 1950–2010 .....   | 1–14  |
| Facility   |       |
| Percentage of Trucks by Fleet Size and Primary Fueling Facility, 2002 .....  | 5–9   |
| Share of Trucks by Major Use and Primary Fueling Facility, 2002.....   | 5–10  |
| Features   |       |
| Share of Heavy Trucks with Selected Electronic Features, 2002 .....  | 5–12  |
| Federal  |       |
| Average Miles per Domestic Federal Vehicle by Vehicle Type, 2010 .....   | 7–4   |
| Federal Government Vehicles, 2001–2010 .....   | 7–5   |
| Federal Fleet Vehicle Acquisitions by Fuel Type, FY 2002–2010 .....  | 7–6   |
| Fuel Consumed by Federal Government Fleets, FY 2000–2010 .....   | 7–6   |

|  |       |
|--|-------|
| Federal (continued)  |       |
| Federal Government Vehicles by Agency, FY 2010.....  | 7-7   |
| Federal Excise Taxes on Motor Fuels, 2009 .....  | 10-11 |
| Federal and State Alternative Fuel Incentives, 2011 .....  | 10-12 |
| Federal and State Advanced Technology Incentives, 2011 .....   | 10-13 |
| Feedstocks   |       |
| GREET Model Feedstocks and Fuels.....  | 11-10 |
| Fines  |       |
| Corporate Average Fuel Economy (CAFE) Fines Collected, 1983-2009 .....   | 4-23  |
| Fiscal   |       |
| Federal Fleet Vehicle Acquisitions by Fuel Type, FY 2002- 2009 .....   | 7-6   |
| Fuel Consumed by Federal Government Fleets, FY 2000-2009 .....   | 7-6   |
| Federal Government Vehicles by Agency, FY 2009.....  | 7-7   |
| Five   |       |
| Representative Number Five Driving Cycle .....   | 4-34  |
| Distribution of Five-Axle Tractor-Trailers by On-Road Vehicle Weight, 2008 .....   | 5-20  |
| Fixed  |       |
| Fixed Car Operating Costs per Year, 1975-2010.....   | 10-17 |
| Fleet  |       |
| Percentage of Trucks by Fleet Size and Primary Fueling Facility, 2002 .....  | 5-9   |
| Fleet Vehicles and Characteristics.....  | 7-1   |
| Fleet Vehicles in Service as of January 1, 2010.....   | 7-2   |
| New Light Fleet Vehicle Registrations by Vehicle Type, Model Year 2009.....  | 7-3   |
| Average Length of Time Business Fleet Vehicles are in Service, 2009 .....  | 7-3   |
| Average Annual Vehicle-Miles of Travel for Business Fleet Vehicles, 2009.....  | 7-3   |
| Federal Fleet Vehicle Acquisitions by Fuel Type, FY 2002-2010 .....  | 7-6   |
| Fleets   |       |
| Fuel Consumed by Federal Government Fleets, FY 2000-2010 .....   | 7-6   |
| Flow   |       |
| Growth of Freight in the United States: Comparison of the 1997, 2002 and 2007 Commodity<br>Flow Surveys .....                | 5-22  |
| Growth of Freight Miles in the United States: Comparison of the 1997, 2002 and<br>2007 Commodity Flow Surveys .....          | 5-23  |
| Footprint  |       |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import Cars<br>by Size Class, Model Years 1975-2010 .....         | 11-13 |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import<br>Light Trucks by Size Class, Model Years 1975-2010 ..... | 11-14 |
| Average Annual Carbon Footprint by Vehicle Classification, 1975 and 2010 .....   | 11-15 |
| Fossil   |       |
| World Fossil Fuel Potential.....   | 1-2   |
| U.S. Carbon Emissions from Fossil Energy Consumption by End-Use<br>Sector, 1990-2009 .....                                   | 11-6  |

## Four-Tire

|   |     |
|---|-----|
| Summary Statistics for Two-Axle, Four-Tire Trucks, 1970–2009..... | 4–3 |
|---|-----|

## Freight

|   |      |
|---|------|
| Energy Intensities of Freight Modes, 1970–2009 .....  | 2–19 |
| Growth of Freight in the United States: Comparison of the 1997, 2002 and 2007 Commodity<br>Flow Surveys .....       | 5–22 |
| Growth of Freight Miles in the United States: Comparison of the 1997, 2002 and<br>2007 Commodity Flow Surveys ..... | 5–23 |
| Class I Railroad Freight Systems in the United States Ranked by<br>Revenue Ton–Miles, 2009 .....                    | 9–8  |
| Summary Statistics for Class I Freight Railroads, 1970–2009.....  | 9–9  |

## FTP

|  |      |
|--|------|
| Cold Temperature (Cold FTP) Driving Cycle..... | 4–32 |
|--|------|

## Fuel

|   |      |
|---|------|
| World Fossil Fuel Potential .....   | 1–2  |
| Alternative Fuel and Oxygenate Consumption, 2003–2009 .....   | 2–5  |
| Domestic Consumption of Transportation Energy by Mode and<br>Fuel Type, 2009 .....  | 2–7  |
| Off-highway Transportation-related Fuel Consumption from the NonRoad Model, 2009.....   | 2–11 |
| Fuel Consumption from Lawn and Garden Equipment, 2009.....  | 2–12 |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New<br>Domestic and Import Cars, Selected Model Years 1975–2010 .....                             | 4–7  |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New<br>Domestic and Import Light Trucks, Model Years 1975–2010 .....                              | 4–9  |
| Fuel Economy and Carbon Dioxide Emissions Standards, MY 2012–2016.....  | 4–19 |
| Fuel Economy and Carbon Dioxide Targets for Model Year 2016.....  | 4–20 |
| Car Corporate Average Fuel Economy (CAFE) Standards versus<br>Sales-Weighted Fuel Economy Estimates, 1978–2011 .....  | 4–21 |
| Light Truck Corporate Average Fuel Economy (CAFE) Standards versus<br>Sales-Weighted Fuel Economy Estimates, 1978–2011 .....  | 4–22 |
| Corporate Average Fuel Economy (CAFE) Fines Collected, 1983–2009 .....  | 4–23 |
| Fuel Economy by Speed, PSAT Model Results.....  | 4–26 |
| Fuel Economy by Speed, 1973, 1984, and 1997 Studies .....   | 4–28 |
| Steady Speed Fuel Economy for Vehicles Tested in the 1997 Study.....  | 4–29 |
| Projected Fuel Economies from U.S., European, and Japanese Driving Cycles.....  | 4–35 |
| Truck Harmonic Mean Fuel Economy by Size Class, 1992, 1997, and 2002.....   | 5–6  |
| Effect of Terrain on Class 8 Truck Fuel Economy.....  | 5–14 |
| Fuel Economy for Class 8 Trucks as Function of Speed and Tractor-Trailer<br>Tire Combination .....  | 5–15 |
| Class 8 Truck Fuel Economy as a Function of Speed and Tractor-Trailer Tire<br>Combination and Percentage of Total Distance Traveled as a Function<br>of Speed ..... | 5–16 |
| Class 8 Truck Percent of Total Fuel Consumed as a Function of Speed and<br>Tractor-Trailer Tire Combination.....  | 5–17 |
| Alternative Fuel and Advanced Technology Vehicles and Characteristics.....  | 6–1  |
| Estimates of Alternative Fuel Vehicles in Use, 1995–2009 .....  | 6–3  |
| Alternative Fuel Transit Vehicles, 2009.....  | 6–4  |
| Alternative Fuel Vehicles Available by Manufacturer, Model Year 2011.....   | 6–5  |
| Number of Alternative Refuel Sites by State and Fuel Type, 2011 .....   | 6–8  |
| Federal Fleet Vehicle Acquisitions by Fuel Type, FY 2002–2010 .....   | 7–6  |

## Fuel (continued)

|   |       |
|---|-------|
| Fuel Consumed by Federal Government Fleets, FY 2000–2010 .....                        | 7–6   |
| Diesel Fuel Prices for Selected Countries, 1998–2010 .....                            | 10–4  |
| Retail Prices for Motor Fuel, 1978–2010 .....   | 10–8  |
| Refiner Sales Prices for Aviation Gasoline and Jet Fuel, 1978–2010 .....              | 10–10 |
| Federal and State Alternative Fuel Incentives, 2011 .....                             | 10–12 |
| Carbon Dioxide Emissions from a Gallon of Fuel .....                                  | 11–16 |
| Highway, Nonroad, Locomotive, and Marine (NRLM) Diesel Fuel<br>Sulfur Standards ..... | 12–37 |

## Fueling

|   |      |
|---|------|
| Percentage of Trucks by Fleet Size and Primary Fueling Facility, 2002 ..... | 5–9  |
| Share of Trucks by Major Use and Primary Fueling Facility, 2002 .....       | 5–10 |

## Fuels

|  |       |
|--|-------|
| Properties of Conventional and Alternative Fuels .....                   | 6–11  |
| Federal Excise Taxes on Motor Fuels, 2009 .....                          | 10–11 |
| REET Model Feedstocks and Fuels .....                                    | 11–10 |
| Well-to-Wheel Emissions for Various Fuels and Vehicle Technologies ..... | 11–11 |

## Function

|   |      |
|---|------|
| Fuel Economy for Class 8 Trucks as Function of Speed and Tractor-Trailer<br>Tire Combination .....  | 5–15 |
| Class 8 Truck Fuel Economy as a Function of Speed and Tractor-Trailer Tire<br>Combination and Percentage of Total Distance Traveled as a Function<br>of Speed ..... | 5–16 |
| Class 8 Truck Percent of Total Fuel Consumed as a Function of Speed and<br>Tractor-Trailer Tire Combination .....   | 5–17 |

## Gallon

|  |       |
|--|-------|
| Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978–2010 ..... | 10–7  |
| Carbon Dioxide Emissions from a Gallon of Fuel .....                       | 11–16 |

## Garden

|   |      |
|---|------|
| Fuel Consumption from Lawn and Garden Equipment, 2009 ..... | 2–12 |
|---|------|

## Gas

|  |      |
|--|------|
| World Natural Gas Reserves, Production and Consumption, 2009 .....   | 1–7  |
| The Gas Guzzler Tax on New Cars .....                                | 4–24 |
| Tax Receipts from the Sale of Gas Guzzlers, 1980–2008 .....          | 4–25 |
| Greenhouse Gas Emissions .....                                       | 11–1 |
| Transportation Greenhouse Gas Emissions by Mode, 1990 and 2009 ..... | 11–8 |

## Gases

|   |      |
|---|------|
| U.S. Emissions of Greenhouse Gases, based on Global Warming Potential,<br>1990–2009 ..... | 11–4 |
|---|------|

## Gasohol

|  |       |
|--|-------|
| State Tax Exemptions for Gasohol, 2009 ..... | 10–11 |
|--|-------|

## Gasoline

|   |      |
|---|------|
| Highway Usage of Gasoline and Diesel, 1973–2009 .....       | 2–13 |
| Gasoline Prices for Selected Countries, 1990 and 2010 ..... | 10–3 |

|   |       |
|---|-------|
| Gasoline (continued)  |       |
| Gasoline Prices for Selected Countries, 1990 and 2010.....  | 10-5  |
| Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978-2010.....   | 10-7  |
| Refiner Sales Prices for Aviation Gasoline and Jet Fuel, 1978-2010.....   | 10-10 |
| Gasoline Sulfur Standards .....   | 12-36 |
| General   |       |
| Summary Statistics for General Aviation, 1970-2009 .....  | 9-4   |
| Global  |       |
| Numerical Estimates of Global Warming Potentials Compared with Carbon Dioxide .....                                 | 11-3  |
| U.S. Emissions of Greenhouse Gases, based on Global Warming Potential,<br>1990-2009 .....                           | 11-4  |
| Glossary  |       |
| Glossary .....  | G-1   |
| Government  |       |
| Federal Government Vehicles, 2001-2010 .....  | 7-5   |
| Fuel Consumed by Federal Government Fleets, FY 2000-2010 .....  | 7-6   |
| Federal Government Vehicles by Agency, FY 2010.....   | 7-7   |
| Greenhouse  |       |
| Greenhouse Gas Emissions .....  | 11-1  |
| U.S. Emissions of Greenhouse Gases, based on Global Warming Potential,<br>1990-2009 .....                           | 11-4  |
| Total U.S. Greenhouse Emissions by End-Use Sector, 2009 .....   | 11-5  |
| Transportation Greenhouse Gas Emissions by Mode, 1990 and 2009 .....  | 11-8  |
| GREET   |       |
| GREET Model.....  | 11-9  |
| GREET Model Feedstocks and Fuels.....   | 11-10 |
| Gross   |       |
| Refinery Gross Output by World Region, 2000 and 2010 .....  | 1-11  |
| New Retail Sales of Trucks 10,000 Pounds GVW and Less in the United States, 1970-2010.....                          | 4-6   |
| New Retail Truck Sales by Gross Vehicle Weight, 1970-2010.....  | 5-4   |
| Truck Statistics by Gross Vehicle Weight Class, 2002 .....  | 5-6   |
| Gross Vehicle Weight vs. Empty Vehicle Weight .....   | 5-19  |
| Growth  |       |
| Oil Price and Economic Growth, 1970-2010.....   | 1-9   |
| Growth of Freight in the United States: Comparison of the 1997, 2002 and 2007 Commodity<br>Flow Surveys .....       | 5-22  |
| Growth of Freight Miles in the United States: Comparison of the 1997, 2002 and<br>2007 Commodity Flow Surveys ..... | 5-23  |
| Guzzler   |       |
| The Gas Guzzler Tax on New Cars .....   | 4-24  |
| Guzzlers  |       |
| Tax Receipts from the Sale of Gas Guzzlers, 1980-2008 .....   | 4-25  |

|  |       |
|--|-------|
| Harmonic   |       |
| Truck Harmonic Mean Fuel Economy by Size Class, 1992, 1997, and 2002 .....   | 5–6   |
| Heavy  |       |
| Energy Intensity of Heavy Rail Systems, 2009 .....   | 2–18  |
| Heavy Truck Scrappage and Survival Rates .....   | 3–17  |
| Heavy Vehicles and Characteristics .....   | 5–1   |
| Summary Statistics for Heavy Single-Unit Trucks, 1970–2009 .....   | 5–2   |
| Share of Heavy Trucks with Selected Electronic Features, 2002 .....  | 5–12  |
| Heavy-Duty Highway Compression-Ignition Engines and Urban Buses –<br>Exhaust Emission Standards .....                                    | 12–16 |
| Heavy-Duty Highway Spark-Ignition Engines – Exhaust Emission<br>Standards .....  | 12–18 |
| Heavy-Duty Highway Compression Ignition and Spark-Ignition Engines –<br>Evaporative Emission Standards .....                             | 12–20 |
| High   |       |
| High Speed (US06) Driving Cycle .....  | 4–33  |
| Highway  |       |
| Highway Transportation Petroleum Consumption by Mode, 1970–2010 .....  | 1–19  |
| Highway Transportation Energy Consumption by Mode, 1970–2009 .....   | 2–9   |
| Highway Usage of Gasoline and Diesel, 1973–2009 .....  | 2–13  |
| Energy Intensities of Highway Passenger Modes, 1970–2009 .....   | 2–15  |
| Shares of Highway Vehicle-Miles Traveled by Vehicle Type, 1970–2009 .....  | 3–10  |
| Highway Driving Cycle .....  | 4–31  |
| Emissions of Carbon Monoxide from Highway Vehicles, 1970–2005 .....  | 12–4  |
| Emissions of Nitrogen Oxides from Highway Vehicles, 1970–2005 .....  | 12–6  |
| Emissions of Volatile Organic Compounds from Highway Vehicles, 1970–2005 .....   | 12–8  |
| Emissions of Particulate Matter (PM–10) from Highway Vehicles, 1970–2005 .....   | 12–10 |
| Emissions of Particulate Matter (PM–2.5) from Highway Vehicles, 1990–2005 .....  | 12–12 |
| Heavy-Duty Highway Compression-Ignition Engines and Urban Buses –<br>Exhaust Emission Standards .....                                    | 12–16 |
| Heavy-Duty Highway Spark-Ignition Engines – Exhaust Emission<br>Standards .....  | 12–18 |
| Heavy-Duty Highway Compression Ignition and Spark-Ignition Engines –<br>Evaporative Emission Standards .....                             | 12–20 |
| Highway, Nonroad, Locomotive, and Marine (NRLM) Diesel Fuel<br>Sulfur Standards .....  | 12–37 |
| Household  |       |
| Household Vehicles and Characteristics .....   | 8–1   |
| Household Vehicle Ownership, 1960–2009 Census .....  | 8–5   |
| Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per<br>Household 1969, 1977, 1983, 1990, 1995 NPTS and 2001, 2009 NHTS ..... | 8–7   |
| Average Number of Vehicles and Vehicle Travel per Household,<br>1990 NPTS and 2001 and 2009 NHTS .....                                   | 8–8   |
| Average Annual Miles per Household Vehicle by Vehicle Age .....  | 8–12  |
| Household Vehicle Trips, 2009 NHTS .....   | 8–16  |
| Daily Vehicle Miles of Travel (per Vehicle) by Number of Vehicles in the<br>Household, 2009 NHTS .....                                   | 8–17  |
| Daily and Annual Vehicle Miles of Travel and Average Age for Each Vehicle<br>in a Household, 2009 NHTS .....                             | 8–17  |

|   |       |
|---|-------|
| Household (continued)   |       |
| Daily Vehicle Miles of Travel for Each Vehicle in a Household, 2009 NHTS .....  | 8–18  |
| Annual Vehicle Miles of Travel for Each Vehicle in a Household, 2009 NHTS.....  | 8–18  |
| Households  |       |
| Average Annual Expenditures of Households by Income, 2009.....  | 8–4   |
| Housing   |       |
| Housing Unit Characteristics, 2009.....   | 8–20  |
| Hybrid  |       |
| Hybrid Electric Vehicles Available by Manufacturer, Model Year 2011 .....   | 6–7   |
| Ignition  |       |
| Heavy-Duty Highway Compression-Ignition Engines and Urban Buses –<br>Exhaust Emission Standards .....                                   | 12–16 |
| Heavy-Duty Highway Spark-Ignition Engines – Exhaust Emission<br>Standards.....  | 12–18 |
| Heavy-Duty Highway Compression Ignition and Spark-Ignition Engines –<br>Evaporative Emission Standards.....                             | 12–20 |
| Nonroad Compression-Ignition Engines – Exhaust Emission Standards.....  | 12–23 |
| Nonroad Large Spark-Ignition Engines – Exhaust and Evaporative<br>Emission Standards.....   | 12–25 |
| Marine Compression-Ignition (CI) Engines – Exhaust Emission<br>Standards.....   | 12–28 |
| Marine Spark-Ignition Engines and Vessels – Exhaust Emission<br>Standards.....  | 12–32 |
| Import  |       |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New<br>Domestic and Import Cars, Selected Model Years 1975–2010 ..... | 4–7   |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New<br>Domestic and Import Light Trucks, Model Years 1975–2010 .....  | 4–9   |
| Sales-Weighted Engine Size of New Domestic and Import Cars<br>by Size Class, Model Years 1975–2010 .....                                | 4–12  |
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks<br>by Size Class, Model Years 1975–2010 .....                        | 4–13  |
| Sales-Weighted Curb Weight of New Domestic and Import Cars<br>by Size Class, Model Years 1975–2010 .....                                | 4–14  |
| Sales-Weighted Interior Space of New Domestic and Import Cars by Size Class,<br>Model Years 1977–2010.....                              | 4–15  |
| Average Price of a New Car (Domestic and Import), 1970–2009 .....   | 10–15 |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import Cars<br>by Size Class, Model Years 1975–2010 .....                    | 11–13 |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import<br>Light Trucks by Size Class, Model Years 1975–2010 .....            | 11–14 |
| Important   |       |
| Petroleum Production and Consumption and Some Important Percent<br>Shares, 1950–2010.....   | 1–15  |
| Imports   |       |
| U.S. Petroleum Imports by World Region of Origin, 1960–2010.....  | 1–8   |

|  |       |
|--|-------|
| Imports (continued)  |       |
| United States Petroleum Production, Imports and Exports, 1950–2010 .....   | 1–14  |
| Incentives   |       |
| Federal and State Alternative Fuel Incentives, 2011 .....  | 10–12 |
| Federal and State Advanced Technology Incentives, 2011 .....   | 10–13 |
| Income   |       |
| Average Annual Expenditures of Households by Income, 2009 .....  | 8–4   |
| Index  |       |
| Transportation Services Index, January 1990–January 2011 .....   | 10–2  |
| Indices  |       |
| Consumer Price Indices, 1970–2010 .....  | 10–18 |
| Input  |       |
| U.S. Refinery Input of Crude Oil and Petroleum Products, 1987–2009 .....   | 1–12  |
| Intensities  |       |
| Energy Intensities of Highway Passenger Modes, 1970–2009 .....   | 2–15  |
| Energy Intensities of Nonhighway Passenger Modes, 1970–2009 .....  | 2–16  |
| Energy Intensities of Freight Modes, 1970–2009 .....   | 2–19  |
| Intensity  |       |
| Energy Intensity of Light Rail Transit Systems, 2009 .....   | 2–17  |
| Energy Intensity of Heavy Rail Systems, 2009 .....   | 2–18  |
| Energy Intensity of Commuter Rail Systems, 2009 .....  | 2–18  |
| Interior   |       |
| Sales-Weighted Interior Space of New Domestic and Import Cars by Size Class,<br>Model Years 1977–2010 .....                  | 4–15  |
| Intermodal   |       |
| Intermodal Rail Traffic, 1965–2009 .....   | 9–10  |
| International  |       |
| Summary Statistics for U.S. Domestic and International Certificated Route<br>Air Carriers (Combined Totals), 1970–2009 ..... | 9–3   |
| Tonnage Statistics for Domestic and International Waterborne<br>Commerce, 1970–2009 .....                                    | 9–5   |
| Japanese   |       |
| Projected Fuel Economies from U.S., European, and Japanese Driving Cycles .....  | 4–35  |
| Comparison of U.S., European, and Japanese Driving Cycles .....  | 4–36  |
| Jet  |       |
| Refiner Sales Prices for Aviation Gasoline and Jet Fuel, 1978–2010 .....   | 10–10 |
| Large  |       |
| Nonroad Large Spark-Ignition Engines – Exhaust and Evaporative<br>Emission Standards .....                                   | 12–25 |



|  |       |
|--|-------|
| Lawn   |       |
| Fuel Consumption from Lawn and Garden Equipment, 2009.....   | 2–12  |
| Length   |       |
| Average Length of Time Business Fleet Vehicles are in Service, 2009 .....  | 7–3   |
| Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per<br>Household 1969, 1977, 1983, 1990, 1995 NPTS and 2001, 2009 NHTS ..... | 8–7   |
| Lifetime   |       |
| Car and Light Truck Survivability Rates and Lifetime Miles .....   | 3–18  |
| Light  |       |
| Energy Intensity of Light Rail Transit Systems, 2009 .....   | 2–17  |
| Light Truck Scrappage and Survival Rates .....   | 3–16  |
| Car and Light Truck Survivability Rates and Lifetime Miles .....   | 3–18  |
| Light Vehicles and Characteristics.....  | 4–1   |
| Summary Statistics on Class 1, Class 2a, and Class 2b Light Trucks .....   | 4–4   |
| Sales Estimates of Class 1, Class 2a, and Class 2b Light Trucks, 1989–1999.....  | 4–4   |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New<br>Domestic and Import Light Trucks, Model Years 1975–2010 .....   | 4–9   |
| Light Vehicle Market Shares by Size Class, Model Years 1975–2010.....  | 4–10  |
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks<br>by Size Class, Model Years 1975–2010 .....                         | 4–13  |
| Average Material Consumption for a Light Vehicle, Model Years 1995, 2000,<br>and 2009.....   | 4–16  |
| New Light Vehicle Dealerships and Sales, 1970–2009 .....   | 4–17  |
| Light Truck Corporate Average Fuel Economy (CAFE) Standards versus<br>Sales-Weighted Fuel Economy Estimates, 1978–2011 .....             | 4–22  |
| New Light Fleet Vehicle Registrations by Vehicle Type, Model Year 2009.....  | 7–3   |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import<br>Light Trucks by Size Class, Model Years 1975–2010 .....             | 11–14 |
| Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger<br>Vehicle – Tier 2 Exhaust Emission Standards.....                      | 12–14 |
| Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger<br>Vehicle – Tier 2 Evaporative Emission Standards.....                  | 12–15 |
| California Car, Light Truck and Medium Truck Emission Certification<br>Standards.....  | 12–21 |
| Locomotive   |       |
| Highway, Nonroad, Locomotive, and Marine (NRLM) Diesel Fuel<br>Sulfur Standards.....   | 12–37 |
| Locomotives  |       |
| Locomotives – Exhaust Emission Standards.....  | 12–26 |
| Long-Distance  |       |
| Long-Distance Trip Characteristics, 2001 NHTS .....  | 8–25  |
| Major  |       |
| Percentage of Trucks by Size Ranked by Major Use, 2002 .....   | 5–8   |
| Share of Trucks by Major Use and Primary Fueling Facility, 2002.....   | 5–10  |

|   |       |
|---|-------|
| Manufacturer  |       |
| Alternative Fuel Vehicles Available by Manufacturer, Model Year 2011 .....      | 6-5   |
| Hybrid Electric Vehicles Available by Manufacturer, Model Year 2011 .....       | 6-7   |
| Manufacturing   |       |
| U.S. Employment for Motor Vehicles and Motor Vehicle Parts                      |       |
| Manufacturing, 1990-2010 .....  | 10-20 |
| Maps  |       |
| Appendix C. Maps .....  | C-1   |
| Marine  |       |
| Marine Compression-Ignition (CI) Engines – Exhaust Emission                     |       |
| Standards .....   | 12-28 |
| Marine Spark-Ignition Engines and Vessels – Exhaust Emission                    |       |
| Standards .....   | 12-32 |
| Highway, Nonroad, Locomotive, and Marine (NRLM) Diesel Fuel                     |       |
| Sulfur Standards .....  | 12-37 |
| Market  |       |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New           |       |
| Domestic and Import Cars, Selected Model Years 1975-2010 .....                  | 4-7   |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New           |       |
| Domestic and Import Light Trucks, Model Years 1975-2010 .....                   | 4-9   |
| Light Vehicle Market Shares by Size Class, Model Years 1975-2010 .....          | 4-10  |
| Light Vehicle Market Shares, Model Years 1975-2010 .....                        | 4-11  |
| Material  |       |
| Average Material Consumption for a Light Vehicle, Model Years 1995, 2000,       |       |
| and 2009 .....  | 4-16  |
| Matter  |       |
| Total National Emissions of Particulate Matter (PM-10), 1970-2008 .....         | 12-9  |
| Emissions of Particulate Matter (PM-10) from Highway Vehicles, 1970-2005 .....  | 12-10 |
| Total National Emissions of Particulate Matter (PM-2.5), 1990-2008 .....        | 12-11 |
| Emissions of Particulate Matter (PM-2.5) from Highway Vehicles, 1990-2005 ..... | 12-12 |
| Mean  |       |
| Truck Harmonic Mean Fuel Economy by Size Class, 1992, 1997, and 2002 .....      | 5-6   |
| Means   |       |
| Means of Transportation to Work, 1980, 1990 and 2000 Census .....               | 8-19  |
| Medium  |       |
| Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger                 |       |
| Vehicle – Tier 2 Exhaust Emission Standards .....                               | 12-14 |
| Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger                 |       |
| Vehicle – Tier 2 Evaporative Emission Standards .....                           | 12-15 |
| California Car, Light Truck and Medium Truck Emission Certification             |       |
| Standards .....   | 12-21 |
| Methodologies   |       |
| Appendix A. Sources & Methodologies .....                                       | A-1   |

## Mile

|  |       |
|--|-------|
| Car Operating Cost per Mile, 1985–2010 ..... | 10–16 |
|--|-------|

## Miles

|  |      |
|--|------|
| Shares of Highway Vehicle-Miles Traveled by Vehicle Type, 1970–2009 .....      | 3–10 |
| Car and Light Truck Survivability Rates and Lifetime Miles .....               | 3–18 |
| Distribution of Trucks over 26,000 lbs. Less than Two Years Old by Vehicle-    |      |
| Miles Traveled .....   | 5–11 |
| Growth of Freight Miles in the United States: Comparison of the 1997, 2002 and |      |
| 2007 Commodity Flow Surveys .....  | 5–23 |
| Average Annual Vehicle-Miles of Travel for Business Fleet Vehicles, 2009.....  | 7–3  |
| Average Miles per Domestic Federal Vehicle by Vehicle Type, 2010 .....         | 7–4  |
| Vehicles and Vehicle-Miles per Capita, 1950–2009 .....                         | 8–3  |
| Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per                |      |
| Household 1969, 1977, 1983, 1990, 1995 NPTS and 2001, 2009 NHTS .....          | 8–7  |
| Average Annual Miles per Household Vehicle by Vehicle Age.....                 | 8–12 |
| Self-Reported vs. Odometer Average Annual Miles, 1995 NPTS and                 |      |
| 2001 NHTS .....  | 8–13 |
| Share of Vehicles by Annual Miles of Travel and Vehicle Age, 2009 NHTS .....   | 8–15 |
| Average Daily Miles Driven (per Driver), 2009 NHTS .....                       | 8–16 |
| Daily Vehicle Miles of Travel (per Vehicle) by Number of Vehicles in the       |      |
| Household, 2009 NHTS.....  | 8–17 |
| Daily and Annual Vehicle Miles of Travel and Average Age for Each Vehicle      |      |
| in a Household, 2009 NHTS .....  | 8–17 |
| Daily Vehicle Miles of Travel for Each Vehicle in a Household, 2009 NHTS ..... | 8–18 |
| Annual Vehicle Miles of Travel for Each Vehicle in a Household, 2009 NHTS..... | 8–18 |

## Mode

|   |      |
|---|------|
| Highway Transportation Petroleum Consumption by Mode, 1970–2010.....    | 1–19 |
| Nonhighway Transportation Petroleum Consumption by Mode, 1970–2009..... | 1–20 |
| Transportation Petroleum Use by Mode, 2008–2009.....                    | 1–21 |
| Domestic Consumption of Transportation Energy by Mode and               |      |
| Fuel Type, 2009 .....   | 2–7  |
| Transportation Energy Use by Mode, 2008–2009.....                       | 2–8  |
| Highway Transportation Energy Consumption by Mode, 1970–2009.....       | 2–9  |
| Nonhighway Transportation Energy Consumption by Mode, 1970–2009.....    | 2–10 |
| Transportation Greenhouse Gas Emissions by Mode, 1990 and 2009 .....    | 11–8 |

## Model

|   |      |
|---|------|
| Off-highway Transportation-related Fuel Consumption from the NonRoad Model, 2009..... | 2–11 |
| Car Scrappage and Survival Rates, 1970, 1980 and 1990 Model Years .....               | 3–15 |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New                 |      |
| Domestic and Import Cars, Selected Model Years 1975–2010 .....                        | 4–7  |
| Definition of Wagons in Model Year 2010 .....   | 4–8  |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New                 |      |
| Domestic and Import Light Trucks, Model Years 1975–2010 .....                         | 4–9  |
| Light Vehicle Market Shares by Size Class, Model Years 1975–2010.....                 | 4–10 |
| Light Vehicle Market Shares, Model Years 1975–2010 .....                              | 4–11 |
| Sales-Weighted Engine Size of New Domestic and Import Cars                            |      |
| by Size Class, Model Years 1975–2010 .....  | 4–12 |
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks                    |      |
| by Size Class, Model Years 1975–2010 .....  | 4–13 |

## Model (continued)

|  |       |
|--|-------|
| Sales-Weighted Curb Weight of New Domestic and Import Cars<br>by Size Class, Model Years 1975–2010 .....                     | 4–14  |
| Sales-Weighted Interior Space of New Domestic and Import Cars by Size Class,<br>Model Years 1977–2010.....                   | 4–15  |
| Average Material Consumption for a Light Vehicle, Model Years 1995, 2000,<br>and 2009.....                                   | 4–16  |
| Fuel Economy and Carbon Dioxide Emissions Standards, MY 2012–2016.....   | 4–19  |
| Fuel Economy and Carbon Dioxide Targets for Model Year 2016.....   | 4–20  |
| Fuel Economy by Speed, PSAT Model Results.....   | 4–26  |
| Alternative Fuel Vehicles Available by Manufacturer, Model Year 2011.....  | 6–5   |
| Hybrid Electric Vehicles Available by Manufacturer, Model Year 2011 .....  | 6–7   |
| New Light Fleet Vehicle Registrations by Vehicle Type, Model Year 2009.....  | 7–3   |
| GREET Model.....   | 11–9  |
| GREET Model Feedstocks and Fuels.....  | 11–10 |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import Cars<br>by Size Class, Model Years 1975–2010 .....         | 11–13 |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import<br>Light Trucks by Size Class, Model Years 1975–2010 ..... | 11–14 |

## Modes

|   |      |
|---|------|
| Energy Intensities of Highway Passenger Modes, 1970–2009 .....    | 2–15 |
| Energy Intensities of Nonhighway Passenger Modes, 1970–2009 ..... | 2–16 |
| Energy Intensities of Freight Modes, 1970–2009 .....              | 2–19 |
| Nonhighway Modes .....  | 9–1  |

## Monoxide

|  |      |
|--|------|
| Total National Emissions of Carbon Monoxide, 1970–2008 .....       | 12–3 |
| Emissions of Carbon Monoxide from Highway Vehicles, 1970–2005..... | 12–4 |

## Motor

|   |       |
|---|-------|
| Retail Prices for Motor Fuel, 1978–2010 .....   | 10–8  |
| Federal Excise Taxes on Motor Fuels, 2009 .....   | 10–11 |
| U.S. Employment for Motor Vehicles and Motor Vehicle Parts<br>Manufacturing, 1990–2010..... | 10–20 |

## National

|   |       |
|---|-------|
| Summary Statistics for the National Railroad Passenger Corporation<br>(Amtrak), 1971–2009 ..... | 9–11  |
| Total National Emissions of the Criteria Air Pollutants by Sector, 2008.....                    | 12–2  |
| Total National Emissions of Carbon Monoxide, 1970–2008 .....                                    | 12–3  |
| Total National Emissions of Nitrogen Oxides, 1970–2008.....                                     | 12–5  |
| Total National Emissions of Volatile Organic Compounds, 1970–2008 .....                         | 12–7  |
| Total National Emissions of Particulate Matter (PM-10), 1970–2008 .....                         | 12–9  |
| Total National Emissions of Particulate Matter (PM-2.5), 1990–2008.....                         | 12–11 |

## Natural

|  |     |
|--|-----|
| World Natural Gas Reserves, Production and Consumption, 2009 ..... | 1–7 |
|--|-----|

## New

|  |      |
|--|------|
| New Retail Vehicle Sales, 1970–2010 .....                  | 3–14 |
| New Retail Car Sales in the United States, 1970–2010 ..... | 4–5  |

## New (continued)

|  |       |
|--|-------|
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Cars, Selected Model Years 1975–2010 ..... | 4–7   |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Light Trucks, Model Years 1975–2010 .....  | 4–9   |
| Sales-Weighted Engine Size of New Domestic and Import Cars by Size Class, Model Years 1975–2010 .....                                | 4–12  |
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class, Model Years 1975–2010 .....                        | 4–13  |
| Sales-Weighted Curb Weight of New Domestic and Import Cars by Size Class, Model Years 1975–2010 .....                                | 4–14  |
| Sales-Weighted Interior Space of New Domestic and Import Cars by Size Class, Model Years 1977–2010.....                              | 4–15  |
| New Light Vehicle Dealerships and Sales, 1970–2009 .....   | 4–17  |
| The Gas Guzzler Tax on New Cars .....  | 4–24  |
| New Retail Truck Sales by Gross Vehicle Weight, 1970–2010.....   | 5–4   |
| New Light Fleet Vehicle Registrations by Vehicle Type, Model Year 2009.....  | 7–3   |
| Average Price of a New Car, 1906–2009 .....  | 10–14 |
| Average Price of a New Car (Domestic and Import), 1970–2009 .....  | 10–15 |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import Cars by Size Class, Model Years 1975–2010 .....                    | 11–13 |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import Light Trucks by Size Class, Model Years 1975–2010 .....            | 11–14 |

## New York

|                                  |      |
|----------------------------------|------|
| New York City Driving Cycle..... | 4–34 |
|----------------------------------|------|

## NHTS

|   |      |
|---|------|
| Demographic Statistics from the 1969, 1977, 1983, 1990, 1995 NPTS and 2001, 2009 NHTS .....   | 8–6  |
| Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per Household 1969, 1977, 1983, 1990, 1995 NPTS and 2001, 2009 NHTS ..... | 8–7  |
| Average Number of Vehicles and Vehicle Travel per Household, 1990 NPTS and 2001 and 2009 NHTS.....                                    | 8–8  |
| Trip Statistics by Trip Purpose, 2001 and 2009 NHTS.....  | 8–9  |
| Average Vehicle Occupancy by Vehicle Type, 1995 NPTS and 2009 NHTS .....  | 8–10 |
| Average Vehicle Occupancy by Trip Purpose, 1977 NPTS and 2009 NHTS .....  | 8–11 |
| Self-Reported vs. Odometer Average Annual Miles, 1995 NPTS and 2001 NHTS .....  | 8–13 |
| Share of Vehicle Trips by Trip Distance, 2009 NHTS.....   | 8–14 |
| Share of Vehicle Trips to Work by Trip Distance, 2009 NHTS .....  | 8–14 |
| Share of Vehicles by Annual Miles of Travel and Vehicle Age, 2009 NHTS.....   | 8–15 |
| Household Vehicle Trips, 2009 NHTS .....  | 8–16 |
| Average Daily Miles Driven (per Driver), 2009 NHTS .....  | 8–16 |
| Daily Vehicle Miles of Travel (per Vehicle) by Number of Vehicles in the Household, 2009 NHTS.....                                    | 8–17 |
| Daily and Annual Vehicle Miles of Travel and Average Age for Each Vehicle in a Household, 2009 NHTS .....                             | 8–17 |
| Daily Vehicle Miles of Travel for Each Vehicle in a Household, 2009 NHTS .....  | 8–18 |
| Annual Vehicle Miles of Travel for Each Vehicle in a Household, 2009 NHTS.....  | 8–18 |
| Walk and Bike Trips by Trip Purpose, 2009 NHTS .....  | 8–23 |

|  |       |
|--|-------|
| NHTS (continued)   |       |
| Long-Distance Trip Characteristics, 2001 NHTS .....  | 8–25  |
| Nitrogen   |       |
| Total National Emissions of Nitrogen Oxides, 1970–2008.....  | 12–5  |
| Emissions of Nitrogen Oxides from Highway Vehicles, 1970–2005.....   | 12–6  |
| Nonhighway   |       |
| Nonhighway Transportation Petroleum Consumption by Mode, 1970–2009 .....   | 1–20  |
| Nonhighway Transportation Energy Consumption by Mode, 1970–2009.....   | 2–10  |
| Energy Intensities of Nonhighway Passenger Modes, 1970–2009 .....  | 2–16  |
| Nonhighway Modes .....   | 9–1   |
| Nonhighway Energy Use Shares, 1970–2009 .....  | 9–2   |
| NonRoad  |       |
| Off-highway Transportation-related Fuel Consumption from the NonRoad Model, 2009 .....   | 2–11  |
| Nonroad Compression-Ignition Engines – Exhaust Emission Standards.....   | 12–23 |
| Nonroad Large Spark-Ignition Engines – Exhaust and Evaporative<br>Emission Standards.....  | 12–25 |
| Nonroad Recreational Engines and Vehicles – Exhaust Emission<br>Standards .....  | 12–34 |
| Highway, Nonroad, Locomotive, and Marine (NRLM) Diesel Fuel<br>Sulfur Standards.....   | 12–37 |
| NPTS   |       |
| Demographic Statistics from the 1969, 1977, 1983, 1990, 1995 NPTS<br>and 2001, 2009 NHTS .....   | 8–6   |
| Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per<br>Household 1969, 1977, 1983, 1990, 1995 NPTS and 2001, 2009 NHTS ..... | 8–7   |
| Average Number of Vehicles and Vehicle Travel per Household,<br>1990 NPTS and 2001 and 2009 NHTS.....                                    | 8–8   |
| Average Vehicle Occupancy by Vehicle Type, 1995 NPTS and<br>2009 NHTS .....  | 8–10  |
| Average Vehicle Occupancy by Trip Purpose, 1977 NPTS and<br>2009 NHTS .....  | 8–11  |
| Self-Reported vs. Odometer Average Annual Miles, 1995 NPTS and<br>2001 NHTS .....  | 8–13  |
| Number   |       |
| Representative Number Five Driving Cycle .....   | 4–34  |
| Number of Alternative Refuel Sites by State and Fuel Type, 2011 .....  | 6–8   |
| Average Number of Vehicles and Vehicle Travel per Household,<br>1990 NPTS and 2001 and 2009 NHTS.....                                    | 8–8   |
| Daily Vehicle Miles of Travel (per Vehicle) by Number of Vehicles in the<br>Household, 2009 NHTS.....                                    | 8–17  |
| Refiner Sales Prices for Propane and No. 2 Diesel, 1978–2010 .....   | 10–9  |
| Numerical  |       |
| Numerical Estimates of Global Warming Potentials Compared with Carbon Dioxide .....  | 11–3  |
| Occupancy  |       |
| Average Vehicle Occupancy by Vehicle Type, 1995 NPTS and<br>2009 NHTS .....  | 8–10  |

|   |       |
|---|-------|
| Occupancy (continued)   |       |
| Average Vehicle Occupancy by Trip Purpose, 1977 NPTS and 2009 NHTS .....                            | 8-11  |
| Odometer  |       |
| Self-Reported vs. Odometer Average Annual Miles, 1995 NPTS and 2001 NHTS .....                      | 8-13  |
| Off-highway   |       |
| Off-highway Transportation-related Fuel Consumption from the NonRoad Model, 2009 .....              | 2-11  |
| Oil   |       |
| World Crude Oil Production, 1960–2010 .....   | 1-3   |
| World Oil Reserves, Production and Consumption, 2009 .....  | 1-6   |
| Oil Price and Economic Growth, 1970–2010 .....  | 1-9   |
| Costs of Oil Dependence to the U.S. Economy, 1970–2010 .....  | 1-10  |
| U.S. Refinery Input of Crude Oil and Petroleum Products, 1987–2009 .....                            | 1-12  |
| Refinery Yield of Petroleum Products From a Barrel of Crude Oil, 1978-2010 .....                    | 1-13  |
| Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978–2009 .....                          | 10-7  |
| On-Road   |       |
| Distribution of Five-Axle Tractor-Trailers by On-Road Vehicle Weight, 2008 .....                    | 5-20  |
| Organic   |       |
| Total National Emissions of Volatile Organic Compounds, 1970–2008 .....                             | 12-7  |
| Emissions of Volatile Organic Compounds from Highway Vehicles, 1970–2005 .....                      | 12-8  |
| Origin  |       |
| U.S. Petroleum Imports by World Region of Origin, 1960–2010 .....                                   | 1-8   |
| Operating   |       |
| Car Operating Cost per Mile, 1985–2010 .....  | 10-16 |
| Fixed Car Operating Costs per Year, 1975–2010 .....   | 10-17 |
| Operation   |       |
| Cars in Operation and Vehicle Travel by Age, 1970 and 2001 .....                                    | 3-11  |
| Trucks in Operation and Vehicle Travel by Age, 1970 and 2001 .....                                  | 3-12  |
| Operations  |       |
| Summary Statistics for Commuter Rail Operations, 1984–2009 .....                                    | 9-12  |
| Summary Statistics for Rail Transit Operations, 1970–2009 .....                                     | 9-13  |
| Other   |       |
| Vehicles per Thousand People: U.S. (Over Time) Compared to Other Countries (in 1999 and 2009) ..... | 3-6   |
| Vehicles per Thousand People in Other Countries, 1999 and 2009 .....                                | 3-8   |
| Output  |       |
| Refinery Gross Output by World Region, 2000 and 2010 .....  | 1-11  |
| Ownership   |       |
| Household Vehicle Ownership, 1960–2009 Census .....   | 8-5   |

## Oxides

|  |      |
|--|------|
| Total National Emissions of Nitrogen Oxides, 1970–2008.....        | 12–5 |
| Emissions of Nitrogen Oxides from Highway Vehicles, 1970–2005..... | 12–6 |

## Oxygenate

|   |     |
|---|-----|
| Alternative Fuel and Oxygenate Consumption, 2003–2009 ..... | 2–5 |
|---|-----|

## Particulate

|  |       |
|--|-------|
| Total National Emissions of Particulate Matter (PM–10), 1970–2008.....         | 12–9  |
| Emissions of Particulate Matter (PM–10) from Highway Vehicles, 1970–2005.....  | 12–10 |
| Total National Emissions of Particulate Matter (PM–2.5), 1990–2008.....        | 12–11 |
| Emissions of Particulate Matter (PM–2.5) from Highway Vehicles, 1990–2005..... | 12–12 |

## Parts

|   |       |
|---|-------|
| U.S. Employment for Motor Vehicles and Motor Vehicle Parts<br>Manufacturing, 1990–2010..... | 10–20 |
|---|-------|

## Passenger

|   |       |
|---|-------|
| Passenger Travel and Energy Use, 2009 .....   | 2–14  |
| Energy Intensities of Highway Passenger Modes, 1970–2009 .....  | 2–15  |
| Energy Intensities of Nonhighway Passenger Modes, 1970–2009 .....   | 2–16  |
| Summary Statistics for the National Railroad Passenger Corporation<br>(Amtrak), 1971–2009.....                          | 9–11  |
| Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger<br>Vehicle – Tier 2 Exhaust Emission Standards .....    | 12–14 |
| Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger<br>Vehicle – Tier 2 Evaporative Emission Standards..... | 12–15 |

## People

|  |     |
|--|-----|
| Vehicles per Thousand People: U.S. (Over Time) Compared to Other<br>Countries (in 1999 and 2009) ..... | 3–6 |
| Vehicles per Thousand People in Other Countries, 1999 and 2009 .....                                   | 3–8 |
| Vehicles per Thousand People in the United States, 1990–2009 .....                                     | 3–9 |

## Percent

|   |      |
|---|------|
| Petroleum Production and Consumption and Some Important Percent<br>Shares, 1950–2010.....                         | 1–15 |
| Class 8 Truck Percent of Total Fuel Consumed as a Function of Speed and<br>Tractor-Trailer Tire Combination ..... | 5–17 |

## Percentage

|   |      |
|---|------|
| Percentage of Trucks by Size Ranked by Major Use, 2002 .....  | 5–8  |
| Percentage of Trucks by Fleet Size and Primary Fueling Facility, 2002 .....   | 5–9  |
| Class 8 Truck Fuel Economy as a Function of Speed and Tractor-Trailer Tire<br>Combination and Percentage of Total Distance Traveled as a Function<br>of Speed ..... | 5–16 |

## Period

|   |     |
|---|-----|
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New<br>Domestic and Import Cars, Selected Model Years 1975–2010 ..... | 4–7 |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New<br>Domestic and Import Light Trucks, Model Years 1975–2010 .....  | 4–9 |



|   |       |
|---|-------|
| Personal  |       |
| Personal Consumption Expenditures, 1970–2010.....   | 10–18 |
| Petroleum   |       |
| World Petroleum Production, 1973–2010.....  | 1–4   |
| World Petroleum Consumption, 1960–2010.....   | 1–5   |
| U.S. Petroleum Imports by World Region of Origin, 1960–2010.....                                    | 1–8   |
| U.S. Refinery Input of Crude Oil and Petroleum Products, 1987–2009 .....                            | 1–12  |
| Refinery Yield of Petroleum Products From a Barrel of Crude Oil, 1978–2010.....                     | 1–13  |
| United States Petroleum Production, Imports and Exports, 1950–2010.....                             | 1–14  |
| Petroleum Production and Consumption and Some Important Percent<br>Shares, 1950–2010.....           | 1–15  |
| United States Petroleum Production and Consumption – All Sectors,<br>1973–2035 .....                | 1–16  |
| United States Petroleum Production, Transportation and Consumption,<br>1970–2035 .....              | 1–17  |
| Consumption of Petroleum by End-Use Sector, 1973–2010.....  | 1–18  |
| Highway Transportation Petroleum Consumption by Mode, 1970–2010.....                                | 1–19  |
| Nonhighway Transportation Petroleum Consumption by Mode, 1970–2009.....                             | 1–20  |
| Transportation Petroleum Use by Mode, 2008–2009.....  | 1–21  |
| PM-10   |       |
| Total National Emissions of Particulate Matter (PM-10), 1970–2008.....                              | 12–9  |
| Emissions of Particulate Matter (PM-10) from Highway Vehicles, 1970–2005.....                       | 12–10 |
| PM-2.5  |       |
| Total National Emissions of Particulate Matter (PM-2.5), 1990–2008.....                             | 12–11 |
| Emissions of Particulate Matter (PM-2.5) from Highway Vehicles, 1990–2005.....                      | 12–12 |
| Pollutants  |       |
| Criteria Air Pollutants .....   | 12–1  |
| Total National Emissions of the Criteria Air Pollutants by Sector, 2008.....                        | 12–2  |
| Population  |       |
| Population and Vehicle Profile, 1950–2009.....  | 8–2   |
| Potential   |       |
| World Fossil Fuel Potential.....  | 1–2   |
| U.S. Emissions of Greenhouse Gases, based on Global Warming Potential,<br>1990–2009 .....           | 11–4  |
| Potentials  |       |
| Numerical Estimates of Global Warming Potentials Compared with Carbon Dioxide .....                 | 11–3  |
| Pounds  |       |
| New Retail Sales of Trucks 10,000 Pounds GVW and Less in the United States, 1970–2010.....          | 4–6   |
| Distribution of Trucks over 26,000 lbs. Less than Two Years Old by Vehicle-<br>Miles Traveled ..... | 5–11  |
| Price   |       |
| Oil Price and Economic Growth, 1970–2010.....   | 1–9   |
| Average Price of a New Car, 1906–2009.....  | 10–14 |
| Average Price of a New Car (Domestic and Import), 1970–2009 .....                                   | 10–15 |

|   |       |
|---|-------|
| Price (continued)   |       |
| Consumer Price Indices, 1970–2010.....  | 10–18 |
| Prices  |       |
| Gasoline Prices for Selected Countries, 1990–2010 .....                                   | 10–3  |
| Diesel Fuel Prices for Selected Countries, 1998–2010 .....                                | 10–4  |
| Gasoline Prices for Selected Countries, 1990 and 2010.....                                | 10–5  |
| Diesel Prices for Selected Countries, 1990 and 2010.....                                  | 10–6  |
| Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978–2010.....                 | 10–7  |
| Retail Prices for Motor Fuel, 1978–2010 .....   | 10–8  |
| Refiner Sales Prices for Propane and No. 2 Diesel, 1978–2010 .....                        | 10–9  |
| Refiner Sales Prices for Aviation Gasoline and Jet Fuel, 1978–2010.....                   | 10–10 |
| Primary   |       |
| World Consumption of Primary Energy, 2008.....  | 2–2   |
| Percentage of Trucks by Fleet Size and Primary Fueling Facility, 2002 .....               | 5–9   |
| Share of Trucks by Major Use and Primary Fueling Facility, 2002.....                      | 5–10  |
| Production  |       |
| World Crude Oil Production, 1960–2010 .....   | 1–3   |
| World Petroleum Production, 1973–2010.....  | 1–4   |
| World Oil Reserves, Production and Consumption, 2009.....                                 | 1–6   |
| World Natural Gas Reserves, Production and Consumption, 2009 .....                        | 1–7   |
| United States Petroleum Production, Imports and Exports, 1950–2010 .....                  | 1–14  |
| Petroleum Production and Consumption and Some Important Percent<br>Shares, 1950–2010..... | 1–15  |
| United States Petroleum Production and Consumption – All Sectors, 1973–2035 .....         | 1–16  |
| United States Petroleum Production, Transportation and Consumption,<br>1970–2035 .....    | 1–17  |
| Products  |       |
| U.S. Refinery Input of Crude Oil and Petroleum Products, 1987–2009 .....                  | 1–12  |
| Refinery Yield of Petroleum Products from a Barrel of Crude Oil, 1978–2010.....           | 1–13  |
| Profile   |       |
| Population and Vehicle Profile, 1950–2009.....  | 8–2   |
| Projected   |       |
| Projected Fuel Economies from U.S., European, and Japanese Driving Cycles.....            | 4–35  |
| Propane   |       |
| Refiner Sales Prices for Propane and No. 2 Diesel, 1978–2010 .....                        | 10–9  |
| Properties  |       |
| Properties of Conventional and Alternative Fuels.....                                     | 6–11  |
| PSAT  |       |
| Fuel Economy by Speed, PSAT Model Results.....  | 4–26  |
| Purpose   |       |
| Trip Statistics by Trip Purpose, 2001 and 2009 NHTS.....                                  | 8–9   |
| Average Vehicle Occupancy by Trip Purpose, 1977 NPTS and<br>2009 NHTS .....               | 8–11  |

|  |       |
|--|-------|
| Purpose (continued)  |       |
| Walk and Bike Trips by Trip Purpose, 2009 NHTS.....  | 8–23  |
| Rail   |       |
| Energy Intensity of Light Rail Transit Systems, 2009 .....                                       | 2–17  |
| Energy Intensity of Heavy Rail Systems, 2009 .....   | 2–18  |
| Energy Intensity of Commuter Rail Systems, 2009 .....  | 2–18  |
| Intermodal Rail Traffic, 1965–2009 .....   | 9–10  |
| Summary Statistics for Commuter Rail Operations, 1984–2009 .....                                 | 9–12  |
| Summary Statistics for Rail Transit Operations, 1970–2009 .....                                  | 9–13  |
| Railroad   |       |
| Class I Railroad Freight Systems in the United States Ranked by<br>Revenue Ton–Miles, 2009 ..... | 9–8   |
| Summary Statistics for the National Railroad Passenger Corporation<br>(Amtrak), 1971–2009 .....  | 9–11  |
| Railroads  |       |
| Summary Statistics for Class I Freight Railroads, 1970–2009 .....                                | 9–9   |
| Ranked   |       |
| Percentage of Trucks by Size Ranked by Major Use, 2002 .....                                     | 5–8   |
| Class I Railroad Freight Systems in the United States Ranked by<br>Revenue Ton–Miles, 2009 ..... | 9–8   |
| Rates  |       |
| Car Scrappage and Survival Rates, 1970, 1980 and 1990 Model Years .....                          | 3–15  |
| Light Truck Scrappage and Survival Rates .....   | 3–16  |
| Heavy Truck Scrappage and Survival Rates .....   | 3–17  |
| Car and Light Truck Survivability Rates and Lifetime Miles .....                                 | 3–18  |
| Receipts   |       |
| Tax Receipts from the Sale of Gas Guzzlers, 1980–2008 .....                                      | 4–25  |
| Recreational   |       |
| Recreational Boat Energy Use, 1970–2009 .....  | 9–7   |
| Nonroad Recreational Engines and Vehicles – Exhaust Emission<br>Standards .....                  | 12–34 |
| Refiner  |       |
| Refiner Sales Prices for Propane and No. 2 Diesel, 1978–2010 .....                               | 10–9  |
| Refiner Sales Prices for Aviation Gasoline and Jet Fuel, 1978–2010 .....                         | 10–10 |
| Refinery   |       |
| Refinery Gross Output by World Region, 2000 and 2010 .....                                       | 1–11  |
| U.S. Refinery Input of Crude Oil and Petroleum Products, 1987–2009 .....                         | 1–12  |
| Refinery Yield of Petroleum Products From a Barrel of Crude Oil, 1978–2010 .....                 | 1–13  |
| Refuel   |       |
| Number of Alternative Refuel Sites by State and Fuel Type, 2011 .....                            | 6–8   |
| Refueling  |       |
| Conventional Refueling Stations, 1993–2009 .....   | 4–18  |

|   |      |
|---|------|
| Region  |      |
| U.S. Petroleum Imports by World Region of Origin, 1960–2010.....  | 1–8  |
| Refinery Gross Output by World Region, 2000 and 2010 .....  | 1–11 |
| Registrations   |      |
| Car Registrations for Selected Countries, 1960–2009.....  | 3–2  |
| Truck and Bus Registrations for Selected Countries, 1960–2009.....  | 3–3  |
| New Light Fleet Vehicle Registrations by Vehicle Type, Model Year 2009.....   | 7–3  |
| Representative  |      |
| Representative Number Five Driving Cycle .....  | 4–34 |
| Reserves  |      |
| World Oil Reserves, Production and Consumption, 2009.....   | 1–6  |
| World Natural Gas Reserves, Production and Consumption, 2009 .....  | 1–7  |
| Response  |      |
| Summary Statistics on Demand Response Vehicles, 1994–2009 .....   | 4–37 |
| Results   |      |
| Fuel Economy by Speed, PSAT Model Results.....  | 4–26 |
| Retail  |      |
| New Retail Vehicle Sales, 1970–2010 .....   | 3–14 |
| New Retail Car Sales in the United States, 1970–2010 .....  | 4–5  |
| New Retail Sales of Trucks 10,000 Pounds GVW and Less in the United States, 1970–2010.....  | 4–6  |
| New Retail Truck Sales by Gross Vehicle Weight, 1970–2010.....  | 5–4  |
| Retail Prices for Motor Fuel, 1978–2010 .....   | 10–8 |
| Revenue   |      |
| Class I Railroad Freight Systems in the United States Ranked by<br>Revenue Ton–Miles, 2009.....   | 9–8  |
| Route   |      |
| Summary Statistics for U.S. Domestic and International Certificated Route<br>Air Carriers (Combined Totals), 1970–2009 .....            | 9–3  |
| Sale  |      |
| Tax Receipts from the Sale of Gas Guzzlers, 1980–2008.....  | 4–25 |
| Sales   |      |
| New Retail Vehicle Sales, 1970–2010 .....   | 3–14 |
| Sales Estimates of Class 1, Class 2a, and Class 2b Light Trucks, 1989–1999.....   | 4–4  |
| New Retail Car Sales in the United States, 1970–2010 .....  | 4–5  |
| New Retail Sales of Trucks 10,000 Pounds GVW and Less in the United States, 1970–2010.....  | 4–6  |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New<br>Domestic and Import Cars, Selected Model Years 1975–2010 ..... | 4–7  |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New<br>Domestic and Import Light Trucks, Model Years 1975–2010 .....  | 4–9  |
| Sales-Weighted Engine Size of New Domestic and Import Cars<br>by Size Class, Model Years 1975–2010 .....                                | 4–12 |
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks<br>by Size Class, Model Years 1975–2010 .....                        | 4–13 |

## Sales (continued)

|  |       |
|--|-------|
| Sales-Weighted Curb Weight of New Domestic and Import Cars<br>by Size Class, Model Years 1975–2010 .....                     | 4–14  |
| Sales-Weighted Interior Space of New Domestic and Import Cars by Size Class,<br>Model Years 1977–2010.....                   | 4–15  |
| New Light Vehicle Dealerships and Sales, 1970–2009 .....   | 4–17  |
| Car Corporate Average Fuel Economy (CAFE) Standards versus<br>Sales-Weighted Fuel Economy Estimates, 1978–2010 .....         | 4–22  |
| Light Truck Corporate Average Fuel Economy (CAFE) Standards versus<br>Sales-Weighted Fuel Economy Estimates, 1978–2011 ..... | 4–22  |
| New Retail Truck Sales by Gross Vehicle Weight, 1970–2010.....   | 5–4   |
| Bicycle Sales, 1981–2009 .....   | 8–22  |
| Refiner Sales Prices for Propane and No. 2 Diesel, 1978–2010 .....   | 10–9  |
| Refiner Sales Prices for Aviation Gasoline and Jet Fuel, 1978–2010.....  | 10–10 |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import Cars<br>by Size Class, Model Years 1975–2010 .....         | 11–13 |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import<br>Light Trucks by Size Class, Model Years 1975–2010 ..... | 11–14 |

## SC03

|   |      |
|---|------|
| Air Conditioning (SC03) Driving Cycle ..... | 4–32 |
|---|------|

## Scrappage

|   |      |
|---|------|
| Car Scrappage and Survival Rates, 1970, 1980 and 1990 Model Years ..... | 3–15 |
| Light Truck Scrappage and Survival Rates .....                          | 3–16 |
| Heavy Truck Scrappage and Survival Rates .....                          | 3–17 |

## Sector

|  |      |
|--|------|
| Consumption of Petroleum by End-Use Sector, 1973–2010.....                                 | 1–18 |
| U. S. Consumption of Total Energy by End-Use Sector, 1973–2010 .....                       | 2–3  |
| Total U.S. Greenhouse Emissions by End-Use Sector, 2009.....                               | 11–5 |
| U.S. Carbon Emissions from Fossil Energy Consumption by End-Use<br>Sector, 1990–2009 ..... | 11–6 |
| U.S. Carbon Emissions from Energy Use in the Transportation<br>Sector, 1990–2009 .....     | 11–7 |
| Total National Emissions of the Criteria Air Pollutants by Sector, 2008.....               | 12–2 |

## Sectors

|  |      |
|--|------|
| United States Petroleum Production and Consumption – All Sectors,<br>1973–2035 ..... | 1–16 |
|--|------|

## Selected

|   |      |
|---|------|
| Car Registrations for Selected Countries, 1960–2009.....  | 3–2  |
| Truck and Bus Registrations for Selected Countries, 1960–2009.....  | 3–3  |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New<br>Domestic and Import Cars, Selected Model Years 1975–2010 ..... | 4–7  |
| Share of Heavy Trucks with Selected Electronic Features, 2002 .....   | 5–12 |
| Gasoline Prices for Selected Countries, 1990–2010 .....   | 10–3 |
| Diesel Fuel Prices for Selected Countries, 1998–2010 .....  | 10–4 |
| Gasoline Prices for Selected Countries, 1990 and 2010.....  | 10–5 |
| Diesel Prices for Selected Countries, 1990 and 2010.....  | 10–6 |

## Self-Reported

|  |      |
|--|------|
| Self-Reported vs. Odometer Average Annual Miles, 1995 NPTS and 2001 NHTS ..... | 8-13 |
|--|------|

## Service

|   |     |
|---|-----|
| Fleet Vehicles in Service as of January 1, 2010 .....                     | 7-2 |
| Average Length of Time Business Fleet Vehicles are in Service, 2009 ..... | 7-3 |

## Services

|  |      |
|--|------|
| Transportation Services Index, January 1990–January 2011 ..... | 10-2 |
|--|------|

## Share

|  |      |
|--|------|
| Share of Trucks by Major Use and Primary Fueling Facility, 2002 .....        | 5-10 |
| Share of Heavy Trucks with Selected Electronic Features, 2002 .....          | 5-12 |
| Share of Vehicle Trips by Trip Distance, 2009 NHTS .....                     | 8-14 |
| Share of Vehicle Trips to Work by Trip Distance, 2009 NHTS .....             | 8-14 |
| Share of Vehicles by Annual Miles of Travel and Vehicle Age, 2009 NHTS ..... | 8-15 |

## Shares

|  |      |
|--|------|
| Petroleum Production and Consumption and Some Important Percent Shares, 1950–2010 .....  | 1-15 |
| Shares of Highway Vehicle-Miles Traveled by Vehicle Type, 1970–2009 .....  | 3-10 |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Cars, Selected Model Years 1975–2010 ..... | 4-7  |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Light Trucks, Model Years 1975–2010 .....  | 4-9  |
| Light Vehicle Market Shares by Size Class, Model Years 1975–2010 .....   | 4-10 |
| Light Vehicle Market Shares, Model Years 1975–2010 .....   | 4-11 |
| Nonhighway Energy Use Shares, 1970–2009 .....  | 9-2  |

## Single-Unit

|  |     |
|--|-----|
| Summary Statistics for Heavy Single-Unit Trucks, 1970–2009 ..... | 5-2 |
|--|-----|

## Sites

|   |     |
|---|-----|
| Number of Alternative Refuel Sites by State and Fuel Type, 2011 ..... | 6-8 |
|---|-----|

## Size

|   |       |
|---|-------|
| Light Vehicle Market Shares by Size Class, Model Years 1975–2010 .....  | 4-10  |
| Sales-Weighted Engine Size of New Domestic and Import Cars by Size Class, Model Years 1975–2010 .....             | 4-12  |
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class, Model Years 1975–2010 .....     | 4-13  |
| Sales-Weighted Curb Weight of New Domestic and Import Cars by Size Class, Model Years 1975–2010 .....             | 4-14  |
| Sales-Weighted Interior Space of New Domestic and Import Cars by Size Class, Model Years 1977–2010 .....          | 4-15  |
| Truck Harmonic Mean Fuel Economy by Size Class, 1992, 1997, and 2002 .....  | 5-6   |
| Truck Statistics by Size, 2002 .....  | 5-7   |
| Percentage of Trucks by Size Ranked by Major Use, 2002 .....  | 5-8   |
| Percentage of Trucks by Fleet Size and Primary Fueling Facility, 2002 .....                                       | 5-9   |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import Cars by Size Class, Model Years 1975–2010 ..... | 11-13 |

## Size (continued)

|  |       |
|--|-------|
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import<br>Light Trucks by Size Class, Model Years 1975-2010 ..... | 11-14 |
|--|-------|

## Source

|  |     |
|--|-----|
| Distribution of Energy Consumption by Source, 1973 and 2010..... | 2-4 |
|--|-----|

## Sources

|  |     |
|--|-----|
| Appendix A. Sources & Methodologies..... | A-1 |
|--|-----|

## Space

|  |      |
|--|------|
| Sales-Weighted Interior Space of New Domestic and Import Cars by Size Class,<br>Model Years 1977-2010..... | 4-15 |
|--|------|

## Spark

|   |       |
|---|-------|
| Heavy-Duty Highway Spark-Ignition Engines – Exhaust Emission<br>Standards.....                              | 12-18 |
| Heavy-Duty Highway Compression Ignition and Spark-Ignition Engines –<br>Evaporative Emission Standards..... | 12-20 |
| Nonroad Large Spark-Ignition Engines – Exhaust and Evaporative<br>Emission Standards.....                   | 12-25 |
| Marine Spark-Ignition Engines and Vessels – Exhaust Emission<br>Standards.....                              | 12-32 |

## Speed

|   |      |
|---|------|
| Fuel Economy by Speed, PSAT Model Results.....  | 4-26 |
| Fuel Economy by Speed, 1973, 1984, and 1997 Studies .....   | 4-28 |
| Steady Speed Fuel Economy for Vehicles Tested in the 1997 Study.....  | 4-29 |
| High Speed (US06) Driving Cycle.....  | 4-33 |
| Fuel Economy for Class 8 Trucks as Function of Speed and Tractor-Trailer<br>Tire Combination.....   | 5-15 |
| Class 8 Truck Fuel Economy as a Function of Speed and Tractor-Trailer Tire<br>Combination and Percentage of Total Distance Traveled as a Function<br>of Speed ..... | 5-16 |
| Class 8 Truck Percent of Total Fuel Consumed as a Function of Speed and<br>Tractor-Trailer Tire Combination.....  | 5-17 |

## Standards

|  |       |
|--|-------|
| Fuel Economy and Carbon Dioxide Emissions Standards, MY 2012-2016.....   | 4-19  |
| Car Corporate Average Fuel Economy (CAFE) Standards versus<br>Sales-Weighted Fuel Economy Estimates, 1978-2011 .....         | 4-21  |
| Light Truck Corporate Average Fuel Economy (CAFE) Standards versus<br>Sales-Weighted Fuel Economy Estimates, 1978-2011 ..... | 4-22  |
| Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger<br>Vehicle – Tier 2 Exhaust Emission Standards.....          | 12-14 |
| Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger<br>Vehicle – Tier 2 Evaporative Emission Standards.....      | 12-15 |
| Heavy-Duty Highway Compression-Ignition Engines and Urban Buses –<br>Exhaust Emission Standards .....                        | 12-16 |
| Heavy-Duty Highway Spark-Ignition Engines – Exhaust Emission<br>Standards.....   | 12-18 |
| Heavy-Duty Highway Compression Ignition and Spark-Ignition Engines –<br>Evaporative Emission Standards.....                  | 12-20 |

## Standards (continued)

|  |       |
|--|-------|
| California Car, Light Truck and Medium Truck Emission Certification Standards.....     | 12-21 |
| Aircraft – Exhaust Emission Standards.....   | 12-22 |
| Nonroad Compression-Ignition Engines – Exhaust Emission Standards.....                 | 12-23 |
| Nonroad Large Spark-Ignition Engines – Exhaust and Evaporative Emission Standards..... | 12-25 |
| Locomotives – Exhaust Emission Standards.....  | 12-26 |
| Marine Compression-Ignition (CI) Engines – Exhaust Emission Standards.....             | 12-28 |
| Marine Spark-Ignition Engines and Vessels – Exhaust Emission Standards.....            | 12-32 |
| Nonroad Recreational Engines and Vehicles – Exhaust Emission Standards .....           | 12-34 |
| Gasoline Sulfur Standards .....  | 12-36 |
| Highway, Nonroad, Locomotive, and Marine (NRLM) Diesel Fuel Sulfur Standards.....      | 12-37 |

## State

|   |       |
|---|-------|
| Number of Alternative Refuel Sites by State and Fuel Type, 2011 ..... | 6-8   |
| State Tax Exemptions for Gasohol, 2009.....                           | 10-11 |
| Federal and State Alternative Fuel Incentives, 2011 .....             | 10-12 |
| Federal and State Advanced Technology Incentives, 2011 .....          | 10-13 |

## States

|  |      |
|--|------|
| U.S. Petroleum Imports by World Region of Origin, 1960–2010.....   | 1-8  |
| Costs of Oil Dependence to the U.S. Economy, 1970–2010.....  | 1-10 |
| U.S. Refinery Input of Crude Oil and Petroleum Products, 1987–2009 .....   | 1-12 |
| United States Petroleum Production, Imports and Exports, 1950–2010 .....   | 1-14 |
| United States Petroleum Production and Consumption – All Sectors, 1973–2035 .....  | 1-16 |
| United States Petroleum Production, Transportation and Consumption, 1970–2035 .....                                      | 1-17 |
| U.S. Consumption of Total Energy by End-Use Sector, 1973–2010 .....  | 2-3  |
| U.S. Cars and Trucks in Use, 1970–2009 .....   | 3-5  |
| Vehicles per Thousand People: U.S. (Over Time) Compared to Other Countries (in 1999 and 2009) .....                      | 3-6  |
| Vehicles per Thousand People in the United States, 1990–2009 .....   | 3-9  |
| U.S. Average Vehicle Age, 1995–2009 .....  | 3-13 |
| New Retail Car Sales in the United States, 1970–2010 .....   | 4-5  |
| New Retail Sales of Trucks 10,000 Pounds GVW and Less in the United States, 1970–2010.....                               | 4-6  |
| Projected Fuel Economies from U.S., European, and Japanese Driving Cycles.....   | 4-35 |
| Comparison of U.S., European, and Japanese Driving Cycles.....   | 4-36 |
| Growth of Freight in the United States: Comparison of the 1997, 2002 and 2007 Commodity Flow Surveys .....               | 5-22 |
| Growth of Freight Miles in the United States: Comparison of the 1997, 2002 and 2007 Commodity Flow Surveys .....         | 5-23 |
| Characteristics of U.S. Daily per Vehicle Driving vs. Dwelling Unit Type and Density .....                               | 8-20 |
| Summary Statistics for U.S. Domestic and International Certificated Route Air Carriers (Combined Totals), 1970–2009..... | 9-3  |
| Class I Railroad Freight Systems in the United States Ranked by Revenue Ton-Miles, 2009.....                             | 9-8  |



## States (continued)

|   |       |
|---|-------|
| U.S. Employment for Motor Vehicles and Motor Vehicle Parts<br>Manufacturing, 1990–2010..... | 10–20 |
| U.S. Emissions of Greenhouse Gases, based on Global Warming Potential,<br>1990–2009 .....   | 11–4  |
| Total U.S. Greenhouse Emissions by End-Use Sector, 2009 .....                               | 11–5  |
| U.S. Carbon Emissions from Fossil Energy Consumption by End-Use<br>Sector, 1990–2009 .....  | 11–6  |
| U.S. Carbon Emissions from Energy Use in the Transportation<br>Sector, 1990–2009 .....      | 11–7  |

## Stations

|  |      |
|--|------|
| Conventional Refueling Stations, 1993–2009 ..... | 4–18 |
|--|------|

## Statistics

|  |      |
|--|------|
| Summary Statistics for Cars, 1970–2009 .....   | 4–2  |
| Summary Statistics for Two-Axle, Four-Tire Trucks, 1970–2009.....  | 4–3  |
| Summary Statistics on Class 1, Class 2a, and Class 2b Light Trucks .....   | 4–4  |
| Summary Statistics on Demand Response Vehicles, 1994–2009 .....  | 4–37 |
| Summary Statistics for Heavy Single-Unit Trucks, 1970–2009 .....   | 5–2  |
| Summary Statistics for Combination Trucks, 1970–2009.....  | 5–3  |
| Truck Statistics by Gross Vehicle Weight Class, 2002 .....   | 5–6  |
| Truck Statistics by Size, 2002 .....   | 5–7  |
| Summary Statistics on Transit Buses and Trolleybuses, 1994–2009 .....  | 5–24 |
| Demographic Statistics from the 1969, 1977, 1983, 1990, 1995 NPTS<br>and 2001, 2009 NHTS .....                               | 8–6  |
| Trip Statistics by Trip Purpose, 2001 and 2009 NHTS.....   | 8–9  |
| Summary Statistics for U.S. Domestic and International Certificated Route<br>Air Carriers (Combined Totals), 1970–2009 ..... | 9–3  |
| Summary Statistics for General Aviation, 1970–2009 .....   | 9–4  |
| Tonnage Statistics for Domestic and International Waterborne<br>Commerce, 1970–2009 .....                                    | 9–5  |
| Summary Statistics for Domestic Waterborne Commerce, 1970–2009 .....   | 9–6  |
| Summary Statistics for Class I Freight Railroads, 1970–2009.....   | 9–9  |
| Summary Statistics for the National Railroad Passenger Corporation<br>(Amtrak), 1971–2009.....                               | 9–11 |
| Summary Statistics for Commuter Rail Operations, 1984–2009 .....   | 9–12 |
| Summary Statistics for Rail Transit Operations, 1970–2009 .....  | 9–13 |

## Steady

|  |      |
|--|------|
| Steady Speed Fuel Economy for Vehicles Tested in the 1997 Study..... | 4–29 |
|--|------|

## Studies

|   |      |
|---|------|
| Fuel Economy by Speed, 1973, 1984, and 1997 Studies ..... | 4–28 |
|---|------|

## Study

|  |      |
|--|------|
| Steady Speed Fuel Economy for Vehicles Tested in the 1997 Study..... | 4–29 |
|--|------|

## Sulphur

|  |       |
|--|-------|
| Gasoline Sulfur Standards .....  | 12–36 |
| Highway, Nonroad, Locomotive, and Marine (NRLM) Diesel Fuel<br>Sulfur Standards..... | 12–37 |

## Summary

|  |      |
|--|------|
| Summary Statistics for Cars, 1970–2009 .....   | 4–2  |
| Summary Statistics for Two-Axle, Four-Tire Trucks, 1970–2009.....  | 4–3  |
| Summary Statistics on Class 1, Class 2a, and Class 2b Light Trucks .....   | 4–4  |
| Summary Statistics on Demand Response Vehicles, 1994–2009 .....  | 4–37 |
| Summary Statistics for Heavy Single-Unit Trucks, 1970–2009 .....   | 5–2  |
| Summary Statistics for Combination Trucks, 1970–2009.....  | 5–3  |
| Summary Statistics on Transit Buses and Trolleybuses, 1994–2009 .....  | 5–24 |
| Summary Statistics for U.S. Domestic and International Certificated Route<br>Air Carriers (Combined Totals), 1970–2009 ..... | 9–3  |
| Summary Statistics for General Aviation, 1970–2009.....  | 9–4  |
| Summary Statistics for Domestic Waterborne Commerce, 1970–2009.....  | 9–6  |
| Summary Statistics for Class I Freight Railroads, 1970–2009.....   | 9–9  |
| Summary Statistics for the National Railroad Passenger Corporation<br>(Amtrak), 1971–2009.....                               | 9–11 |
| Summary Statistics for Commuter Rail Operations, 1984–2009 .....   | 9–12 |
| Summary Statistics for Rail Transit Operations, 1970–2009 .....  | 9–13 |

## Surveys

|   |      |
|---|------|
| Growth of Freight in the United States: Comparison of the 1997, 2002 and 2007 Commodity<br>Flow Surveys .....       | 5–22 |
| Growth of Freight Miles in the United States: Comparison of the 1997, 2002 and<br>2007 Commodity Flow Surveys ..... | 5–23 |

## Survivability

|  |      |
|--|------|
| Car and Light Truck Survivability Rates and Lifetime Miles ..... | 3–18 |
|--|------|

## Survival

|   |      |
|---|------|
| Car Scrappage and Survival Rates, 1970, 1980 and 1990 Model Years ..... | 3–15 |
| Light Truck Scrappage and Survival Rates .....                          | 3–16 |
| Heavy Truck Scrappage and Survival Rates .....                          | 3–17 |

## Systems

|   |      |
|---|------|
| Energy Intensity of Light Rail Transit Systems, 2009 .....                                      | 2–17 |
| Energy Intensity of Heavy Rail Systems, 2009.....   | 2–18 |
| Energy Intensity of Commuter Rail Systems, 2009 .....   | 2–18 |
| Class I Railroad Freight Systems in the United States Ranked by<br>Revenue Ton–Miles, 2009..... | 9–8  |

## Targets

|  |      |
|--|------|
| Fuel Economy and Carbon Dioxide Targets for Model Year 2016..... | 4–20 |
|--|------|

## Tax

|  |       |
|--|-------|
| The Gas Guzzler Tax on New Cars .....                      | 4–24  |
| Tax Receipts from the Sale of Gas Guzzlers, 1980–2008..... | 4–25  |
| State Tax Exemptions for Gasohol, 2009.....                | 10–11 |

## Taxes

|   |       |
|---|-------|
| Federal Excise Taxes on Motor Fuels, 2009 ..... | 10–11 |
|---|-------|

## Technologies

|  |       |
|--|-------|
| Well-to-Wheel Emissions for Various Fuels and Vehicle Technologies ..... | 11–11 |
|--|-------|

|   |       |
|---|-------|
| Technology  |       |
| Alternative Fuel and Advanced Technology Vehicles and Characteristics.....  | 6–1   |
| Federal and State Advanced Technology Incentives, 2011 .....  | 10–13 |
| Temperature   |       |
| Cold Temperature (Cold FTP) Driving Cycle.....  | 4–32  |
| Terrain   |       |
| Effect of Terrain on Class 8 Truck Fuel Economy.....  | 5–14  |
| Tested  |       |
| Steady Speed Fuel Economy for Vehicles Tested in the 1997 Study.....  | 4–29  |
| Thousand  |       |
| Vehicles per Thousand People: U.S. (Over Time) Compared to Other<br>Countries (in 1999 and 2009) .....  | 3–6   |
| Vehicles per Thousand People in Other Countries, 1999 and 2009 .....  | 3–8   |
| Vehicles per Thousand People in the United States, 1990–2009 .....  | 3–9   |
| Tier 2  |       |
| Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger<br>Vehicle – Tier 2 Exhaust Emission Standards .....  | 12–14 |
| Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger<br>Vehicle – Tier 2 Evaporative Emission Standards.....   | 12–15 |
| Time  |       |
| Vehicles per Thousand People: U.S. (Over Time) Compared to Other<br>Countries (in 1999 and 2009) .....  | 3–6   |
| Average Length of Time Business Fleet Vehicles are in Service, 2009 .....   | 7–3   |
| Workers by Commute Time, 1990, 2000 and 2009 .....  | 8–21  |
| Tire  |       |
| Fuel Economy for Class 8 Trucks as Function of Speed and Tractor-Trailer<br>Tire Combination .....  | 5–15  |
| Class 8 Truck Fuel Economy as a Function of Speed and Tractor-Trailer Tire<br>Combination and Percentage of Total Distance Traveled as a Function<br>of Speed ..... | 5–16  |
| Class 8 Truck Percent of Total Fuel Consumed as a Function of Speed and<br>Tractor-Trailer Tire Combination .....   | 5–17  |
| Ton-Miles   |       |
| Class I Railroad Freight Systems in the United States Ranked by<br>Revenue Ton–Miles, 2009 .....  | 9–8   |
| Tonnage   |       |
| Tonnage Statistics for Domestic and International Waterborne<br>Commerce, 1970–2009 .....   | 9–5   |
| Total   |       |
| U. S. Consumption of Total Energy by End-Use Sector, 1973–2010 .....  | 2–3   |
| Class 8 Truck Fuel Economy as a Function of Speed and Tractor-Trailer Tire<br>Combination and Percentage of Total Distance Traveled as a Function<br>of Speed ..... | 5–16  |

## Total (continued)

|   |       |
|---|-------|
| Class 8 Truck Percent of Total Fuel Consumed as a Function of Speed and<br>Tractor-Trailer Tire Combination ..... | 5-17  |
| Total U.S. Greenhouse Emissions by End-Use Sector, 2009 .....   | 11-5  |
| Total National Emissions of the Criteria Air Pollutants by Sector, 2008 .....                                     | 12-2  |
| Total National Emissions of Carbon Monoxide, 1970-2008 .....  | 12-3  |
| Total National Emissions of Nitrogen Oxides, 1970-2008 .....  | 12-5  |
| Total National Emissions of Volatile Organic Compounds, 1970-2008 .....   | 12-7  |
| Total National Emissions of Particulate Matter (PM-10), 1970-2008 .....   | 12-9  |
| Total National Emissions of Particulate Matter (PM-2.5), 1990-2008 .....  | 12-11 |

## Totals

|  |     |
|--|-----|
| Summary Statistics for U.S. Domestic and International Certificated Route<br>Air Carriers (Combined Totals), 1970-2009 ..... | 9-3 |
|--|-----|

## Tractor-Trailer

|   |      |
|---|------|
| Fuel Economy for Class 8 Trucks as Function of Speed and Tractor-Trailer<br>Tire Combination .....  | 5-15 |
| Class 8 Truck Fuel Economy as a Function of Speed and Tractor-Trailer Tire<br>Combination and Percentage of Total Distance Traveled as a Function<br>of Speed ..... | 5-16 |
| Class 8 Truck Percent of Total Fuel Consumed as a Function of Speed and<br>Tractor-Trailer Tire Combination .....   | 5-17 |
| Distribution of Five-Axle Tractor-Trailers by On-Road Vehicle Weight, 2008 .....  | 5-20 |

## Traffic

|  |      |
|--|------|
| Intermodal Rail Traffic, 1965-2009 ..... | 9-10 |
|--|------|

## Transit

|   |      |
|---|------|
| Energy Intensity of Light Rail Transit Systems, 2009 .....            | 2-17 |
| Summary Statistics on Transit Buses and Trolleybuses, 1994-2009 ..... | 5-24 |
| Alternative Fuel Transit Vehicles, 2009 .....                         | 6-4  |
| Summary Statistics for Rail Transit Operations, 1970-2009 .....       | 9-13 |

## Transportation

|  |       |
|--|-------|
| United States Petroleum Production, Transportation and Consumption,<br>1970-2035 ..... | 1-17  |
| Highway Transportation Petroleum Consumption by Mode, 1970-2010 .....                  | 1-19  |
| Nonhighway Transportation Petroleum Consumption by Mode, 1970-2009 .....               | 1-20  |
| Transportation Petroleum Use by Mode, 2008-2009 .....                                  | 1-21  |
| Domestic Consumption of Transportation Energy by Mode and<br>Fuel Type, 2009 .....     | 2-7   |
| Transportation Energy Use by Mode, 2008-2009 .....                                     | 2-8   |
| Highway Transportation Energy Consumption by Mode, 1970-2009 .....                     | 2-9   |
| Nonhighway Transportation Energy Consumption by Mode, 1970-2009 .....                  | 2-10  |
| Off-highway Transportation-related Fuel Consumption from the NonRoad Model, 2009 ..... | 2-11  |
| Means of Transportation to Work, 1980, 1990 and 2000 Census .....                      | 8-19  |
| Transportation and the Economy .....   | 10-1  |
| Transportation Services Index, January 1990-January 2011 .....                         | 10-2  |
| Transportation-related Employment, 2000 and 2010 .....                                 | 10-19 |
| U.S. Carbon Emissions from Energy Use in the Transportation<br>Sector, 1990-2009 ..... | 11-7  |
| Transportation Greenhouse Gas Emissions by Mode, 1990 and 2009 .....                   | 11-8  |

## Travel

|   |      |
|---|------|
| Passenger Travel and Energy Use, 2009 .....   | 2-14 |
| Cars in Operation and Vehicle Travel by Age, 1970 and 2001 .....  | 3-11 |
| Trucks in Operation and Vehicle Travel by Age, 1970 and 2001 .....  | 3-12 |
| Average Annual Vehicle-Miles of Travel for Business Fleet Vehicles, 2009.....                               | 7-3  |
| Average Number of Vehicles and Vehicle Travel per Household,<br>1990 NPTS and 2001 and 2009 NHTS.....       | 8-8  |
| Share of Vehicles by Annual Miles of Travel and Vehicle Age, 2009 NHTS.....                                 | 8-15 |
| Daily Vehicle Miles of Travel (per Vehicle) by Number of Vehicles in the<br>Household, 2009 NHTS.....       | 8-17 |
| Daily and Annual Vehicle Miles of Travel and Average Age for Each Vehicle<br>in a Household, 2009 NHTS..... | 8-17 |
| Daily Vehicle Miles of Travel for Each Vehicle in a Household, 2009 NHTS .....                              | 8-18 |
| Annual Vehicle Miles of Travel for Each Vehicle in a Household, 2009 NHTS.....                              | 8-18 |

## Traveled

|   |      |
|---|------|
| Shares of Highway Vehicle-Miles Traveled by Vehicle Type, 1970-2009.....  | 3-10 |
| Distribution of Trucks over 26,000 lbs. Less than Two Years Old by Vehicle-<br>Miles Traveled .....   | 5-11 |
| Class 8 Truck Fuel Economy as a Function of Speed and Tractor-Trailer Tire<br>Combination and Percentage of Total Distance Traveled as a Function<br>of Speed ..... | 5-16 |

## Trip

|  |      |
|--|------|
| Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per<br>Household 1969, 1977, 1983, 1990, 1995 NPTS and 2001, 2009 NHTS ..... | 8-7  |
| Trip Statistics by Trip Purpose, 2001 and 2009 NHTS.....   | 8-9  |
| Average Vehicle Occupancy by Trip Purpose, 1977 NPTS and<br>2009 NHTS .....  | 8-11 |
| Share of Vehicle Trips by Trip Distance, 2009 NHTS.....  | 8-14 |
| Share of Vehicle Trips to Work by Trip Distance, 2009 NHTS .....   | 8-14 |
| Walk and Bike Trips by Trip Purpose, 2009 NHTS.....  | 8-23 |
| Long-Distance Trip Characteristics, 2001 NHTS .....  | 8-25 |

## Trips

|  |      |
|--|------|
| Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per<br>Household 1969, 1977, 1983, 1990, 1995 NPTS and 2001, 2009 NHTS ..... | 8-7  |
| Share of Vehicle Trips by Trip Distance, 2009 NHTS.....  | 8-14 |
| Share of Vehicle Trips to Work by Trip Distance, 2009 NHTS .....   | 8-14 |
| Household Vehicle Trips, 2009 NHTS .....   | 8-16 |
| Walk and Bike Trips by Trip Purpose, 2009 NHTS.....  | 8-23 |

## Trolleybuses

|   |      |
|---|------|
| Summary Statistics on Transit Buses and Trolleybuses, 1994-2009 ..... | 5-24 |
|---|------|

## Truck

|  |      |
|--|------|
| Truck and Bus Registrations for Selected Countries, 1960-2009.....   | 3-3  |
| Light Truck Scrappage and Survival Rates .....   | 3-16 |
| Heavy Truck Scrappage and Survival Rates .....   | 3-17 |
| Car and Light Truck Survivability Rates and Lifetime Miles .....   | 3-18 |
| Light Truck Corporate Average Fuel Economy (CAFE) Standards versus<br>Sales-Weighted Fuel Economy Estimates, 1978-2011 ..... | 4-22 |
| New Retail Truck Sales by Gross Vehicle Weight, 1970-2010.....   | 5-4  |

## Truck (continued)

|   |       |
|---|-------|
| Truck Statistics by Gross Vehicle Weight Class, 2002 .....  | 5-6   |
| Truck Harmonic Mean Fuel Economy by Size Class, 1992, 1997, and 2002 .....  | 5-6   |
| Truck Statistics by Size, 2002 .....  | 5-7   |
| Effect of Terrain on Class 8 Truck Fuel Economy.....  | 5-14  |
| Class 8 Truck Fuel Economy as a Function of Speed and Tractor-Trailer Tire<br>Combination and Percentage of Total Distance Traveled as a Function<br>of Speed ..... | 5-16  |
| Class 8 Truck Percent of Total Fuel Consumed as a Function of Speed and<br>Tractor-Trailer Tire Combination .....   | 5-17  |
| Class 8 Truck Weight by Component .....   | 5-18  |
| Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger<br>Vehicle – Tier 2 Exhaust Emission Standards .....  | 12-14 |
| Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger<br>Vehicle – Tier 2 Evaporative Emission Standards.....   | 12-15 |
| California Car, Light Truck and Medium Truck Emission Certification<br>Standards.....   | 12-21 |

## Trucks

|  |       |
|--|-------|
| U.S. Cars and Trucks in Use, 1970–2009 .....   | 3-5   |
| Trucks in Operation and Vehicle Travel by Age, 1970 and 2001 .....   | 3-12  |
| Summary Statistics for Two-Axle, Four-Tire Trucks, 1970–2009.....  | 4-3   |
| Summary Statistics on Class 1, Class 2a, and Class 2b Light Trucks .....   | 4-4   |
| Sales Estimates of Class 1, Class 2a, and Class 2b Light Trucks, 1989–1999.....  | 4-4   |
| New Retail Sales of Trucks 10,000 Pounds GVW and Less in the United States, 1970–2010.....   | 4-6   |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New<br>Domestic and Import Light Trucks, Model Years 1975–2010 ..... | 4-9   |
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks<br>by Size Class, Model Years 1975–2010 .....                       | 4-13  |
| Summary Statistics for Heavy Single-Unit Trucks, 1970–2009 .....   | 5-2   |
| Summary Statistics for Combination Trucks, 1970–2009.....  | 5-3   |
| Percentage of Trucks by Size Ranked by Major Use, 2002 .....   | 5-8   |
| Percentage of Trucks by Fleet Size and Primary Fueling Facility, 2002 .....  | 5-9   |
| Share of Trucks by Major Use and Primary Fueling Facility, 2002.....   | 5-10  |
| Distribution of Trucks over 26,000 lbs. Less than Two Years Old by Vehicle-<br>Miles Traveled .....                                    | 5-11  |
| Share of Heavy Trucks with Selected Electronic Features, 2002 .....  | 5-12  |
| Fuel Economy for Class 8 Trucks as Function of Speed and Tractor-Trailer<br>Tire Combination .....                                     | 5-15  |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import<br>Light Trucks by Size Class, Model Years 1975-2010 .....           | 11-14 |

## Two-Axle

|   |     |
|---|-----|
| Summary Statistics for Two-Axle, Four-Tire Trucks, 1970–2009..... | 4-3 |
|---|-----|

## Type

|  |      |
|--|------|
| Domestic Consumption of Transportation Energy by Mode and<br>Fuel Type, 2009 ..... | 2-7  |
| Shares of Highway Vehicle-Miles Traveled by Vehicle Type, 1970–2009.....           | 3-10 |
| Number of Alternative Refuel Sites by State and Fuel Type, 2011 .....              | 6-8  |
| New Light Fleet Vehicle Registrations by Vehicle Type, Model Year 2009.....        | 7-3  |
| Average Miles per Domestic Federal Vehicle by Vehicle Type, 2010.....              | 7-4  |
| Federal Fleet Vehicle Acquisitions by Fuel Type, FY 2002–2010 .....                | 7-6  |

## Type (continued)

|  |      |
|--|------|
| Average Vehicle Occupancy by Vehicle Type, 1995 NPTS and 2009 NHTS .....                   | 8-10 |
| Characteristics of U.S. Daily per Vehicle Driving vs. Dwelling Unit Type and Density ..... | 8-20 |

## Unit

|  |      |
|--|------|
| Summary Statistics for Heavy Single-Unit Trucks, 1970-2009 .....                           | 5-2  |
| Characteristics of U.S. Daily per Vehicle Driving vs. Dwelling Unit Type and Density ..... | 8-20 |
| Housing Unit Characteristics, 2007 .....   | 8-20 |

## United

|   |       |
|---|-------|
| U.S. Petroleum Imports by World Region of Origin, 1960-2010 .....   | 1-8   |
| Costs of Oil Dependence to the U.S. Economy, 1970-2010 .....  | 1-10  |
| U.S. Refinery Input of Crude Oil and Petroleum Products, 1987-2009 .....  | 1-12  |
| United States Petroleum Production, Imports and Exports, 1950-2010 .....  | 1-14  |
| United States Petroleum Production and Consumption – All Sectors, 1973-2035 .....   | 1-16  |
| United States Petroleum Production, Transportation and Consumption, 1970-2035 .....                                       | 1-17  |
| U. S. Consumption of Total Energy by End-Use Sector, 1973-2010 .....  | 2-3   |
| U.S. Cars and Trucks in Use, 1970-2009 .....  | 3-5   |
| Vehicles per Thousand People: U.S. (Over Time) Compared to Other Countries (in 1999 and 2009) .....                       | 3-6   |
| Vehicles per Thousand People in the United States, 1990-2009 .....  | 3-9   |
| U.S. Average Vehicle Age, 1995-2009 .....   | 3-13  |
| New Retail Car Sales in the United States, 1970-2010 .....  | 4-5   |
| New Retail Sales of Trucks 10,000 Pounds GVW and Less in the United States, 1970-2010 .....                               | 4-6   |
| Projected Fuel Economies from U.S., European, and Japanese Driving Cycles .....   | 4-35  |
| Comparison of U.S., European, and Japanese Driving Cycles .....   | 4-36  |
| Growth of Freight in the United States: Comparison of the 1997, 2002 and 2007 Commodity Flow Surveys .....                | 5-22  |
| Growth of Freight Miles in the United States: Comparison of the 1997, 2002 and 2007 Commodity Flow Surveys .....          | 5-23  |
| Characteristics of U.S. Daily per Vehicle Driving vs. Dwelling Unit Type and Density .....                                | 8-20  |
| Summary Statistics for U.S. Domestic and International Certificated Route Air Carriers (Combined Totals), 1970-2009 ..... | 9-3   |
| Class I Railroad Freight Systems in the United States Ranked by Revenue Ton-Miles, 2009 .....                             | 9-8   |
| U.S. Employment for Motor Vehicles and Motor Vehicle Parts Manufacturing, 1990-2010 .....                                 | 10-20 |
| U.S. Emissions of Greenhouse Gases, based on Global Warming Potential, 1990-2009 .....                                    | 11-4  |
| Total U.S. Greenhouse Emissions by End-Use Sector, 2009 .....   | 11-5  |
| U.S. Carbon Emissions from Fossil Energy Consumption by End-Use Sector, 1990-2009 .....                                   | 11-6  |
| U.S. Carbon Emissions from Energy Use in the Transportation Sector, 1990-2009 .....                                       | 11-7  |

## Urban

|   |       |
|---|-------|
| Heavy-Duty Highway Compression-Ignition Engines and Urban Buses –<br>Exhaust Emission Standards ..... | 12–16 |
|---|-------|

## Usage

|   |      |
|---|------|
| Highway Usage of Gasoline and Diesel, 1973–2009 ..... | 2–13 |
|---|------|

## Use

|  |      |
|--|------|
| Transportation Petroleum Use by Mode, 2008–2009 .....                                      | 1–21 |
| U. S. Consumption of Total Energy by End-Use Sector, 1973–2010 .....                       | 2–3  |
| Transportation Energy Use by Mode, 2008–2009 .....   | 2–8  |
| Passenger Travel and Energy Use, 2009 .....  | 2–14 |
| U.S. Cars and Trucks in Use, 1970–2009 .....   | 3–5  |
| Percentage of Trucks by Size Ranked by Major Use, 2002 .....                               | 5–8  |
| Share of Trucks by Major Use and Primary Fueling Facility, 2002 .....                      | 5–10 |
| Estimates of Alternative Fuel Vehicles in Use, 1995–2009 .....                             | 6–3  |
| Nonhighway Energy Use Shares, 1970–2009 .....  | 9–2  |
| Recreational Boat Energy Use, 1970–2009 .....  | 9–7  |
| U.S. Carbon Emissions from Fossil Energy Consumption by End-Use<br>Sector, 1990–2009 ..... | 11–6 |
| U.S. Carbon Emissions from Energy Use in the Transportation<br>Sector, 1990–2009 .....     | 11–7 |

## US06

|                                       |      |
|---------------------------------------|------|
| High Speed (US06) Driving Cycle ..... | 4–33 |
|---------------------------------------|------|

## Various

|  |       |
|--|-------|
| Well-to-Wheel Emissions for Various Fuels and Vehicle Technologies ..... | 11–11 |
|--|-------|

## Vehicle

|  |      |
|--|------|
| Shares of Highway Vehicle-Miles Traveled by Vehicle Type, 1970–2009 .....                      | 3–10 |
| Cars in Operation and Vehicle Travel by Age, 1970 and 2001 .....                               | 3–11 |
| Trucks in Operation and Vehicle Travel by Age, 1970 and 2001 .....                             | 3–12 |
| U.S. Average Vehicle Age, 1995–2009 .....  | 3–13 |
| New Retail Vehicle Sales, 1970–2010 .....  | 3–14 |
| New Retail Sales of Trucks 10,000 Pounds GVW and Less in the<br>United States, 1970–2010 ..... | 4–6  |
| Light Vehicle Market Shares by Size Class, Model Years 1975–2010 .....                         | 4–10 |
| Light Vehicle Market Shares, Model Years 1975–2010 .....                                       | 4–11 |
| Average Material Consumption for a Light Vehicle, Model Years 1995, 2000,<br>and 2009 .....    | 4–16 |
| New Light Vehicle Dealerships and Sales, 1970–2009 .....                                       | 4–17 |
| New Retail Truck Sales by Gross Vehicle Weight, 1970–2010 .....                                | 5–4  |
| Truck Statistics by Gross Vehicle Weight Class, 2002 .....                                     | 5–6  |
| Gross Vehicle Weight vs. Empty Vehicle Weight .....  | 5–19 |
| Distribution of Five-Axle Tractor-Trailers by On-Road Vehicle Weight, 2008 .....               | 5–20 |
| New Light Fleet Vehicle Registrations by Vehicle Type, Model Year 2009 .....                   | 7–3  |
| Average Annual Vehicle-Miles of Travel for Business Fleet Vehicles, 2009 .....                 | 7–3  |
| Average Miles per Domestic Federal Vehicle by Vehicle Type, 2010 .....                         | 7–4  |
| Federal Fleet Vehicle Acquisitions by Fuel Type, FY 2002–2010 .....                            | 7–6  |
| Population and Vehicle Profile, 1950–2009 .....  | 8–2  |
| Household Vehicle Ownership, 1960–2000 Census .....  | 8–5  |



## Vehicle (continued)

|   |       |
|---|-------|
| Average Vehicle Occupancy by Vehicle Type, 1995 NPTS and 2009 NHTS .....  | 8-10  |
| Average Vehicle Occupancy by Trip Purpose, 1977 NPTS and 2009 NHTS .....  | 8-11  |
| Average Annual Miles per Household Vehicle by Vehicle Age .....   | 8-12  |
| Share of Vehicle Trips by Trip Distance, 2009 NHTS .....  | 8-14  |
| Share of Vehicle Trips to Work by Trip Distance, 2009 NHTS .....  | 8-14  |
| Share of Vehicles by Annual Miles of Travel and Vehicle Age, 2009 NHTS .....  | 8-15  |
| Household Vehicle Trips, 2009 NHTS .....  | 8-16  |
| Daily Vehicle Miles of Travel (per Vehicle) by Number of Vehicles in the Household, 2009 NHTS .....                   | 8-17  |
| Daily and Annual Vehicle Miles of Travel and Average Age for Each Vehicle in a Household, 2009 NHTS .....             | 8-17  |
| Daily Vehicle Miles of Travel for Each Vehicle in a Household, 2009 NHTS .....  | 8-18  |
| Annual Vehicle Miles of Travel for Each Vehicle in a Household, 2009 NHTS .....                                       | 8-18  |
| Characteristics of U.S. Daily per Vehicle Driving vs. Dwelling Unit Type and Density .....                            | 8-20  |
| U.S. Employment for Motor Vehicles and Motor Vehicle Parts Manufacturing, 1990–2010 .....                             | 10-20 |
| Well-to-Wheel Emissions for Various Fuels and Vehicle Technologies .....  | 11-11 |
| Average Annual Carbon Footprint by Vehicle Classification, 1975 and 2010 .....  | 11-15 |
| Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger Vehicle – Tier 2 Exhaust Emission Standards .....     | 12-14 |
| Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger Vehicle – Tier 2 Evaporative Emission Standards ..... | 12-15 |

## Vehicle-Miles

|   |      |
|---|------|
| Shares of Highway Vehicle-Miles Traveled by Vehicle Type, 1970–2009 .....   | 3-10 |
| Distribution of Trucks over 26,000 lbs. Less than Two Years Old by Vehicle-Miles Traveled .....                                       | 5-11 |
| Average Annual Vehicle-Miles of Travel for Business Fleet Vehicles, 2009 .....  | 7-3  |
| Vehicles and Vehicle-Miles per Capita, 1950–2009 .....  | 8-3  |
| Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per Household 1969, 1977, 1983, 1990, 1995 NPTS and 2001, 2009 NHTS ..... | 8-7  |

## Vehicles

|   |      |
|---|------|
| Vehicles per Thousand People: U.S. (Over Time) Compared to Other Countries (in 1999 and 2009) ..... | 3-6  |
| Vehicles per Thousand People in Other Countries, 1999 and 2009 .....                                | 3-8  |
| Vehicles per Thousand People in the United States, 1990–2009 .....                                  | 3-9  |
| Light Vehicles and Characteristics .....  | 4-1  |
| Steady Speed Fuel Economy for Vehicles Tested in the 1997 Study .....                               | 4-29 |
| Summary Statistics on Demand Response Vehicles, 1994–2009 .....                                     | 4-37 |
| Heavy Vehicles and Characteristics .....  | 5-1  |
| Alternative Fuel and Advanced Technology Vehicles and Characteristics .....                         | 6-1  |
| Estimates of Alternative Fuel Vehicles in Use, 1995–2009 .....                                      | 6-3  |
| Alternative Fuel Transit Vehicles, 2009 .....   | 6-4  |
| Alternative Fuel Vehicles Available by Manufacturer, Model Year 2011 .....                          | 6-5  |
| Hybrid Electric Vehicles Available by Manufacturer, Model Year 2011 .....                           | 6-7  |
| Fleet Vehicles and Characteristics .....  | 7-1  |
| Fleet Vehicles in Service as of January 1, 2010 .....   | 7-2  |
| Average Length of Time Business Fleet Vehicles are in Service, 2009 .....                           | 7-3  |

## Vehicles (continued)

|   |       |
|---|-------|
| Average Annual Vehicle-Miles of Travel for Business Fleet Vehicles, 2009.....                         | 7-3   |
| Federal Government Vehicles, 2001–2010 .....  | 7-5   |
| Federal Government Vehicles by Agency, FY 2010.....   | 7-7   |
| Household Vehicles and Characteristics .....  | 8-1   |
| Vehicles and Vehicle-Miles per Capita, 1950–2009 .....  | 8-3   |
| Average Number of Vehicles and Vehicle Travel per Household,<br>1990 NPTS and 2001 and 2009 NHTS..... | 8-8   |
| Share of Vehicles by Annual Miles of Travel and Vehicle Age, 2009 NHTS.....                           | 8-15  |
| Daily Vehicle Miles of Travel (per Vehicle) by Number of Vehicles in the<br>Household, 2009 NHTS..... | 8-17  |
| U.S. Employment for Motor Vehicles and Motor Vehicle Parts<br>Manufacturing, 1990–2010.....           | 10-20 |
| Emissions of Carbon Monoxide from Highway Vehicles, 1970–2005.....                                    | 12-4  |
| Emissions of Nitrogen Oxides from Highway Vehicles, 1970–2005.....                                    | 12-6  |
| Emissions of Volatile Organic Compounds from Highway Vehicles, 1970–2005 .....                        | 12-8  |
| Emissions of Particulate Matter (PM-10) from Highway Vehicles, 1970–2005.....                         | 12-10 |
| Emissions of Particulate Matter (PM-2.5) from Highway Vehicles, 1990–2005.....                        | 12-12 |
| Nonroad Recreational Engines and Vehicles – Exhaust Emission<br>Standards .....                       | 12-34 |

## Volatile

|  |      |
|--|------|
| Total National Emissions of Volatile Organic Compounds, 1970–2008 .....        | 12-7 |
| Emissions of Volatile Organic Compounds from Highway Vehicles, 1970–2005 ..... | 12-8 |

## Wagons

|  |     |
|--|-----|
| Definition of Wagons in Model Year 2010..... | 4-8 |
|--|-----|

## Walk

|   |      |
|---|------|
| Walk and Bike Trips by Trip Purpose, 2009 NHTS..... | 8-23 |
|---|------|

## Warming

|   |      |
|---|------|
| Numerical Estimates of Global Warming Potentials Compared with Carbon Dioxide .....       | 11-3 |
| U.S. Emissions of Greenhouse Gases, based on Global Warming Potential,<br>1990–2009 ..... | 11-4 |

## Waterborne

|   |     |
|---|-----|
| Tonnage Statistics for Domestic and International Waterborne<br>Commerce, 1970–2009 ..... | 9-5 |
| Summary Statistics for Domestic Waterborne Commerce, 1970–2009.....                       | 9-6 |

## Weight

|  |      |
|--|------|
| New Retail Sales of Trucks 10,000 Pounds GVW and Less in the<br>United States, 1970–2010 .....           | 4-6  |
| Sales-Weighted Curb Weight of New Domestic and Import Cars<br>by Size Class, Model Years 1975–2010 ..... | 4-14 |
| New Retail Truck Sales by Gross Vehicle Weight, 1970–2010.....   | 5-4  |
| Truck Statistics by Gross Vehicle Weight Class, 2002.....  | 5-6  |
| Class 8 Truck Weight by Component .....  | 5-18 |
| Gross Vehicle Weight vs. Empty Vehicle Weight .....  | 5-19 |
| Distribution of Five-Axle Tractor-Trailers by On-Road Vehicle Weight, 2008.....                          | 5-20 |

## Weighted

|  |       |
|--|-------|
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Cars, Selected Model Years 1975–2010 ..... | 4–7   |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Light Trucks, Model Years 1975–2010 .....  | 4–9   |
| Sales-Weighted Engine Size of New Domestic and Import Cars by Size Class, Model Years 1975–2010 .....                                | 4–12  |
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class, Model Years 1975–2010 .....                        | 4–13  |
| Sales-Weighted Curb Weight of New Domestic and Import Cars by Size Class, Model Years 1975–2010 .....                                | 4–14  |
| Sales-Weighted Interior Space of New Domestic and Import Cars by Size Class, Model Years 1977–2010.....                              | 4–15  |
| Car Corporate Average Fuel Economy (CAFE) Standards versus Sales-Weighted Fuel Economy Estimates, 1978–2011 .....                    | 4–21  |
| Light Truck Corporate Average Fuel Economy (CAFE) Standards versus Sales-Weighted Fuel Economy Estimates, 1978–2011 .....            | 4–22  |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import Cars by Size Class, Model Years 1975–2010 .....                    | 11–13 |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import Light Trucks by Size Class, Model Years 1975–2010 .....            | 11–14 |

## Well

|  |       |
|--|-------|
| Well-to-Wheel Emissions for Various Fuels and Vehicle Technologies ..... | 11–11 |
|--|-------|

## Wheel

|  |       |
|--|-------|
| Well-to-Wheel Emissions for Various Fuels and Vehicle Technologies ..... | 11–11 |
|--|-------|

## Work

|   |      |
|---|------|
| Share of Vehicle Trips to Work by Trip Distance, 2009 NHTS .....  | 8–14 |
| Means of Transportation to Work, 1980, 1990 and 2000 Census ..... | 8–19 |

## Workers

|   |      |
|---|------|
| Workers by Commute Time, 1990 and 2000 Census ..... | 8–21 |
|---|------|

## World

|  |      |
|--|------|
| World Fossil Fuel Potential .....                                  | 1–2  |
| World Crude Oil Production, 1960–2010 .....                        | 1–3  |
| World Petroleum Production, 1973–2010.....                         | 1–4  |
| World Petroleum Consumption, 1960–2010.....                        | 1–5  |
| World Oil Reserves, Production and Consumption, 2009.....          | 1–6  |
| World Natural Gas Reserves, Production and Consumption, 2009 ..... | 1–7  |
| U.S. Petroleum Imports by World Region of Origin, 1960–2010.....   | 1–8  |
| Refinery Gross Output by World Region, 2000 and 2010 .....         | 1–11 |
| World Consumption of Primary Energy, 2008.....                     | 2–2  |
| World Carbon Dioxide Emissions, 1990 and 2007 .....                | 11–2 |

## Year

|   |      |
|---|------|
| Definition of Wagons in Model Year 2010.....                              | 4–8  |
| Fuel Economy and Carbon Dioxide Emissions Standards, MY 2012–2016.....    | 4–19 |
| Fuel Economy and Carbon Dioxide Targets for Model Year 2016.....          | 4–20 |
| Alternative Fuel Vehicles Available by Manufacturer, Model Year 2011..... | 6–5  |
| Hybrid Electric Vehicles Available by Manufacturer, Model Year 2011 ..... | 6–7  |

## Year (continued)

|   |       |
|---|-------|
| New Light Fleet Vehicle Registrations by Vehicle Type, Model Year 2009..... | 7-3   |
| Federal Government Vehicles by Agency, FY 2010.....                         | 7-7   |
| Fixed Car Operating Costs per Year, 1975-2010.....                          | 10-17 |

## Years

|   |       |
|---|-------|
| Car Scrappage and Survival Rates, 1970, 1980 and 1990 Model Years .....   | 3-15  |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New<br>Domestic and Import Cars, Selected Model Years 1975-2010 ..... | 4-7   |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New<br>Domestic and Import Light Trucks, Model Years 1975-2010 .....  | 4-9   |
| Light Vehicle Market Shares by Size Class, Model Years 1975-2010.....   | 4-10  |
| Light Vehicle Market Shares, Model Years 1975-2010 .....  | 4-11  |
| Sales-Weighted Engine Size of New Domestic and Import Cars<br>by Size Class, Model Years 1975-2010 .....                                | 4-12  |
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks<br>by Size Class, Model Years 1975-2010 .....                        | 4-13  |
| Sales-Weighted Curb Weight of New Domestic and Import Cars<br>by Size Class, Model Years 1975-2010 .....                                | 4-14  |
| Sales-Weighted Interior Space of New Domestic and Import Cars<br>by Size Class, Model Years 1977-2010 .....                             | 4-15  |
| Average Material Consumption for a Light Vehicle, Model Years 1995, 2000,<br>and 2009.....  | 4-16  |
| Distribution of Trucks over 26,000 lbs. Less than Two Years Old by Vehicle-<br>Miles Traveled .....                                     | 5-11  |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import Cars<br>by Size Class, Model Years 1975-2010 .....                    | 11-13 |
| Sales-Weighted Annual Carbon Footprint of New Domestic and Import<br>Light Trucks by Size Class, Model Years 1975-2010 .....            | 11-14 |

## Yield

|   |      |
|---|------|
| Refinery Yield of Petroleum Products from a Barrel of Crude Oil,<br>1978-2010 ..... | 1-13 |
|---|------|

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