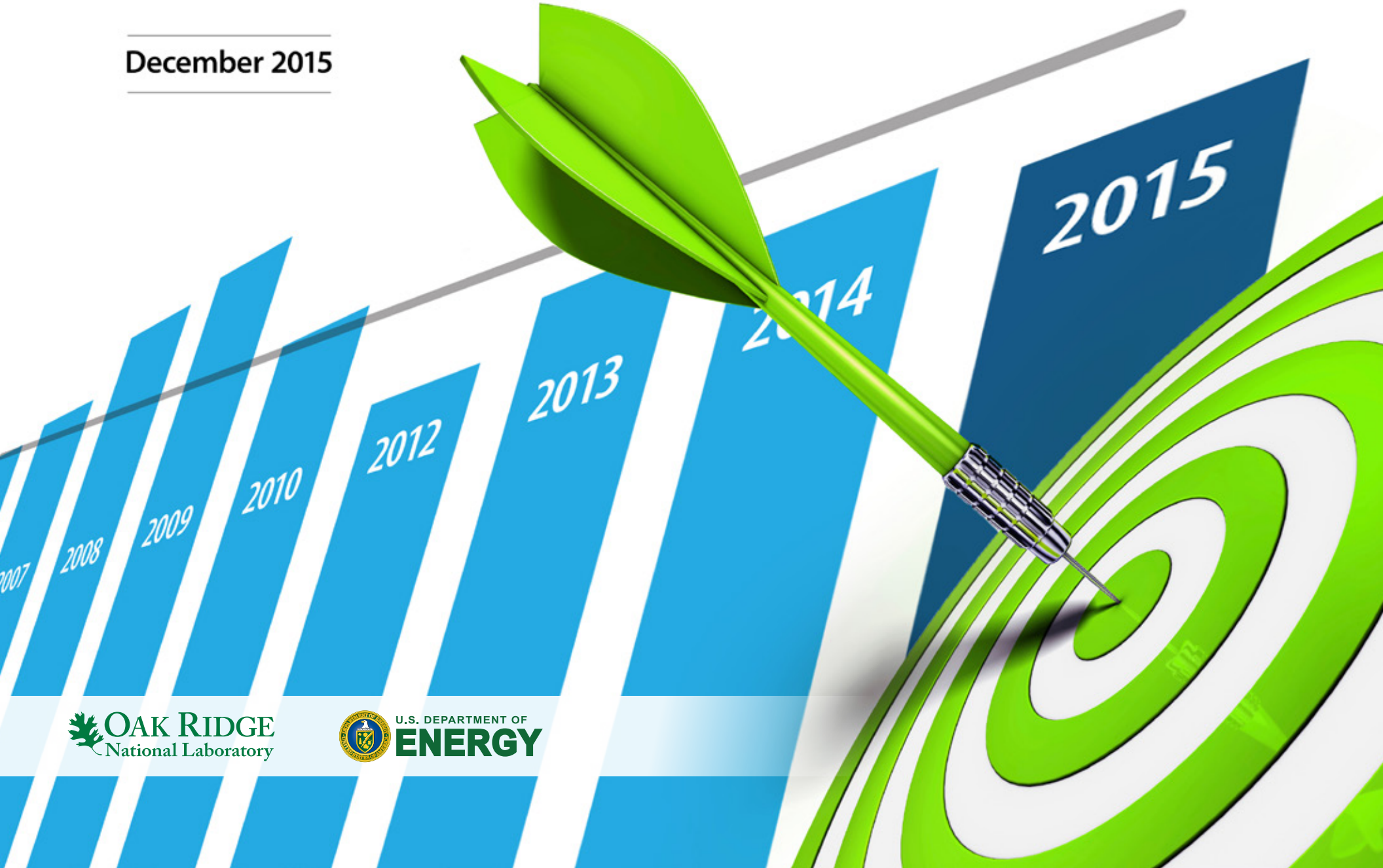
ORNL/TM-2015/667

Site Sustainability Plan

with **FY 2015** Performance Data

December 2015



OAK RIDGE National Laboratory

U.S. DEPARTMENT OF ENERGY

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Site Sustainability Plan with FY 2015 Performance Data

December 2015

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CONTENTS

Acronym List i

I. Executive Summary ii
Executive Summary Table iv

II. Performance Review and Plan Narrative 1

Goal 1: Greenhouse Gas Reduction 1
1.1 GHG Reduction—Scope 1 & 2 1
1.2 GHG Reduction—Scope 3 3

Goal 2: Sustainable Buildings 6
2.1 Energy Intensity Reductions 6
2.2 EISA Section 432 Energy and Water Evaluations 8
2.3 Metering for Individual Buildings 9
2.4 High Performance Sustainable Buildings Guiding Principles 10
2.5 Regional and Local Planning 11
2.6a Net Zero Buildings, Existing Buildings 12
2.6b Net Zero Buildings, New Construction 12
2.7 Data Center Efficiency 13

Goal 3: Clean and Renewable Energy 15
3.1 Clean Energy Goals for Total Electric and Thermal Energy 15
3.2 Renewable Electric Energy Goals 15

Goal 4: Water Use Efficiency and Management 16
4.1 Potable Water Use Intensity 16
4.2 Industrial, Landscaping, and Agricultural Water Consumption 18

Goal 5: Fleet Management 18
5.1 Reductions in Fleet Petroleum Consumption 18
5.2 Fleet Alternative Fuel Consumption 19
5.3 Reductions in Greenhouse Gas Emissions 20
5.4 Light Duty Vehicle Purchases Must Be Alternative Fuel Vehicles 20
5.5 Zero-Emission or Plug-in-Hybrid Electric Vehicles 20

Goal 6: Sustainable Acquisition 21
6.1 Sustainable Acquisition and Procurement 21

Goal 7: Pollution Prevention and Waste Reduction 21
7.1 Reductions of Nonhazardous Solid Waste, Other than C&D Waste 22
7.2 Construction and Demolition Materials and Debris 23

Goal 8: Energy Performance Contracts 25
8.1 Energy Performance Contracts 25

Goal 9: Electronic Stewardship 26
9.1 Electronic Stewardship—Purchases 26
9.2 Electronic Stewardship—Power Management 27
9.3 Electronic Stewardship – Automatic Duplexing 27
9.4 Electronic Stewardship—End of Life 28

Goal 10: Climate Change Resilience 28
10.1 Planning for Climate Change Impacts 28
10.2 Emergency Response 32
10.3 Workforce Health and Safety 32
10.4 Management Commitment 33
10.5 Policies and Programs 34

Earth Day 2015 at ORNL 35

ORNL Health and Wellness Program 36

III. Fleet Management Plan 38

IV. Funding 39

V. Electrical Energy and Utility Cost Projections and High-Energy Mission-Specific Facilities 40

Appendix A: Excluded Buildings Self-Certification Process 44

Appendix B: Policy and Program Statement 48

Appendix C: ORNL Metering Plan 49

ACRONYM LIST

AFV	alternative fuel vehicle
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BQ	business quarter
Btu	British thermal unit
C&D	construction and demolition
CCR	climate change resiliency
CCSI	Climate Change Science Institute
CEDR	Consolidated Energy Data Report
CEDS	Central Energy Data System
CFC	Computation Facilities Complex
CFL	Computers-For-Learning
CNMS	Center for Nanophase Materials Sciences
CSB	Computational Sciences Building
DOE	US Department of Energy
ECM	energy conservation measures
eGRID	EPA Emissions and Generation Resource Integrated Database
EISA	Energy Independence and Security Act
EO	executive order
EPA	US Environmental Protection Agency
EPACT	Energy Policy Act of 1992
EPEAT	Electronic Product Environmental Assessment Tool
ESPC	energy savings performance contract
EUI	energy use intensity
EV	electric vehicle
EVSE	electrical vehicle supply equipment
F&O	Facilities and Operations Directorate
FAR	Federal Acquisition Regulation
FAST	Federal Automotive Statistical Tool
FEMP	Federal Energy Management Program
FFV	flexible fuel vehicle
FIMS	Facilities Information Management System
FMD	Facilities Management Division
ft^2	square feet
FY	fiscal year
G/GSF	gallons per gross square foot
GHG	greenhouse gas
GP	Guiding Principles
GSA	General Services Administration
GSF	gross square foot
HEMSF	high-energy mission-specific facility
HPC	high performance computing
HPSB	high performance sustainable building
HRIBF	Holifield Radioactive Ion Beam Facility
HTML	High Temperature Materials Laboratory
HVAC	heating, ventilating, and air-conditioning
IAV	Impacts, Adaptation, and Vulnerability
ILA	industrial, landscaping, and agricultural
IT	information technology
ITSD	Information Technology Services Division
JCI	Johnson Controls, Inc.
KAT	Knoxville Area Transit
kV	kilovolt
LED	light-emitting diode
LEED	Leadership in Energy and Environmental Design
LLNL	Lawrence Livermore National Laboratory
LSD	Logistical Services Division
LSV	low-speed vehicle
MAP	multimodal access plan
MGY	million gallons per year
MHP`	Managed Hardware Program
MMBtu	million Btu
MSW	municipal solid waste
$MTCO_2e$	metric tons of CO_2 equivalent
MWh	megawatt-hour
N/A	not applicable
NEPA	National Environmental Policy Act
NTRC	National Transportation Research Center
OLCF	Oak Ridge Leadership Computing Facility
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Office
OTC	once-through cooling
P2	pollution prevention
PHEV	plug-in hybrid vehicle
PIN	personal identification number
PSCC	Pellissippi State Community College
PUE	power utilization effectiveness
PV	photovoltaic
R2	Responsible Recycling
RE	renewable energy
RECs	Renewable Energy Credits
SBMS	Standards-Based Management System
SC	DOE Office of Science
SCI	Sustainable Campus Initiative
SF_6	sulfur hexafluoride
SMR	small modular reactor
SNS	Spallation Neutron Source
SPO	Sustainability Performance Office
SSG	Southeast Sustainability Group
SSP	site sustainability plan
T&D	transmission and distribution
TVA	Tennessee Valley Authority
UT	University of Tennessee
WUI	water use intensity

I. Executive Summary

Oak Ridge National Laboratory (ORNL) is both the largest science and energy laboratory in the US Department of Energy (DOE) complex and one of the oldest national laboratories still operating at its original site. ORNL implemented an aggressive modernization program in 2000, providing modern, energy-efficient facilities that help to support the growth of important national scientific missions while faced with the unique and challenging opportunity to integrate sustainability into legacy assets. ORNL is committed to leveraging the outcomes of DOE-sponsored research programs to maximize the efficient use of energy and natural resources across a diverse campus. ORNL leadership in conjunction with the Sustainable Campus Initiative (SCI) maintains a commitment to the integration of technical innovations into new and existing facilities, systems, and processes with a comprehensive approach to achieving DOE directives and the new Executive Order 13693. Energy efficiency, greenhouse gas reductions, climate change resiliency, and other pursuits toward integrated sustainability factor in all we do. ORNL continues to pursue and deploy innovative solutions and initiatives to advance regional, national, and worldwide sustainability and continues to transform its culture and engage employees in supporting sustainability at work, at home, and in the community. The Executive Summary Table summarizes ORNL's FY 2015 performance and planned actions to attain future goals. ORNL continued to achieve numerous successes during FY 2015, which are described in detail throughout this document. The following are some key FY 2015 highlights.

Water Management. Impressive reductions continue to be made in water use intensity, which measured 132 G/GSF in FY 2015 (a reduction of 25% to date, exceeding the DOE FY 2015 target of 16%). ORNL has developed an aggressive plan to reduce water consumption that includes modernizing processes, repairing leaks, replacing old distribution lines, and eliminating once-through cooling where possible.

Pollution Prevention and Waste Diversion Improvements. ORNL achieved a significantly higher diversion rate for municipal solid waste (MSW) in FY 2015 reaching 49%. Through a series of coordinated efforts, ORNL has improved its reduction rate significantly compared to the prior three years in which the MSW diversion rate has averaged 34%.

ORNL Receives 2015 Sustainable Transportation Award. ORNL was presented the 2015 Sustainable Transportation Award from the Tennessee Department of Environment and Conservation for successful onsite electric vehicle (EV) charging at ORNL.

ORNL Receives Award from Local DOE Clean Cities Program. In November 2014, ORNL was presented with the 2014 Davy Crockett Volunteer Leadership award during the East Tennessee Clean Coalition's special 10th anniversary celebration. The award recognized ORNL as a leader in alternative fuel use in the southeast and among national labs.

DOE/Sustainability Performance Office – Sustainability Award. Melissa Lapsa, ORNL's SCI Co-Leader, received the 2014 Sustainability Champion Award for "fervently championing sustainability across ORNL and beyond."

Davy Crockett Volunteer Leadership Award

FY 2015 SUCCESS STORIES

ORNL Institutes New Transportation Route
In August 2015, ORNL's SCI and the University of Tennessee (UT) partnered on a new bus route that connects UT's Knoxville campus, Pellissippi State Community College (PSCC) in west Knox County, and ORNL providing transportation to staff, students, and faculty offering three round-trip routes each day to all three sites. More on this story, see Section 2.5.

Building a Legacy of LEED Success
Adding to one of the largest collections in the southeast of buildings certified by Leadership in Energy and Environmental Design (LEED), ORNL received official notification of an additional LEED Gold Certification (for Building 8930) in October 2015. The new facility will be included in the ORNL High Performance Sustainable Building (HPSB) inventory. The Chestnut Ridge Maintenance Shop (Building 8930) supports the Spallation Neutron Source Complex. The facility consists of an additional 22,305 ft^2 of energy-efficient space for the campus. This increases ORNL's total to 16 LEED facilities, including 7 LEED Gold and 2 LEED Silver buildings.

Auto Duplexing and Shared Printer Services Demonstrate a Sustainable Solution
ORNL has successfully implemented a shared print services program to update existing multifunction print devices and to provide for other shared print devices. All new print services include automatic duplexing set as a default. The shared network printer services model is helping to standardize equipment, reduce energy consumption, reduce landfill waste, reduce the cost of operations, improve printing services in general, and provide more efficient use of consumable products. Over time, ORNL plans to reduce the printer equipment footprint and to save essential overhead costs by reducing toner purchases, support costs, and power demands.

New LED Streetlights Provide More Light and Consume Less Energy
Streets and walkways around sections of ORNL are sporting new light-emitting diode (LED) streetlights that provide greater illumination than the old metal halide fixtures that they replace while using half the power. The new LED streetlights reduce power consumption by 42% per fixture and provide 60% more light. The old fixtures each consumed about 250 Watts, but the new LED lights shine at an equivalent of 400 Watts and only use 146 Watts per fixture. The LED lights will also require less regular maintenance, helping to save on labor costs for years to come.

Crews install the new streetlights on Central Avenue

Zero emissions from an electric motor with wireless charging; Wide Bandgap semi-conductors; and half the weight with the same strength as the original Cobra

"So Joe and I just watched how these folks develop the composites here at Techmer," stated Obama. "That was cool. We lost Joe's attention when we laid eyes on that 3D printed sports car, the carbon fiber Cobra. Biden started pulling out his aviator glasses and we had to explain to him, you don't get to drive on this trip." — President Barack Obama

Source: "ORNL 3D Prints Working Shelby Cobra Replica – President Obama Approves." 3DPrint.com, January 10, 2015. http://3dprint.com/36433/3d-printed-shelby-cobra/

Executive Summary Table of ORNL Attainment of DOE Sustainability Goals

SSPP Goal #	DOE Goal	Performance Status through FY 2015	Planned Actions & Contribution	Risk of Nonattainment
Goal 1: Greenhouse Gas Reduction				
1.1	50% Scope 1 & 2 GHG reduction by FY 2025 from a FY 2008 baseline (2015 target: 19%)	**Scope 1** estimate is 65,388 $MTCO_2e$, a decrease of 27% from FY 2008. **Scope 2** estimate is 330,465 $MTCO_2e$, an increase of 33% from FY 2008 after purchased RECs. **Scope 1 & 2** combined estimate is 395,853 $MTCO_2e$, an increase of 17% from the baseline year of FY 2008.	**Scope 1** reductions are on target due to ECM efforts, ESPC implementation, the new steam plant system, and SF_6 process reductions. **Scope 2** reductions represent a substantial challenge due to growth in electricity demands for mission critical facilities (HEMSFs). REC purchases and innovative technologies will be used to meet the goal by the target year.	Scope 1 Low Scope 2 Low
1.2	25% Scope 3 GHG reduction by FY 2025 from a FY 2008 baseline (2015 target: 6%).	Scope 3 estimate is 44,440 $MTCO_2e$. Overall Scope 3 emissions have increased by 8%. Increased electricity consumption and a 33% increase in T&D losses limits the overall performance. A new electricity sub-station was commissioned onsite in FY 2015.	Continuing focus on employee engagement areas such as responsible business travel (use videoconferencing when possible), employee commutes, and telework program will ensure progress toward Scope 3 reductions. T&D losses will grow along with purchased electricity. As with Scope 2, REC purchases will also produce credits to offset Scope 3 emissions by the target year.	Low
Goal 2: Sustainable Buildings				
2.1	25% energy intensity (Btu/GSF) reduction by FY 2025 from a FY 2015 baseline in goal subject buildings (2.5% reduction per year).	Objective in FY 2015 is to establish the energy intensity baseline. ORNL has calculated the new baseline at 265,326 Btu/GSF.	Ongoing process of energy audits will identify additional energy conservation projects to achieve the annual 2.5% reduction and the new FY 2025 goal of 25%.	Low
2.2	EISA Section 432 energy and water evaluations.	Over 3.9% evaluated during this third year of the current four-year cycle.	Continue pace of 25% or more through current cycle (end of FY 2016). Leverage knowledge from previous cycles to conduct focused evaluations.	Low
2.3	Meter all buildings for electricity, natural gas, steam, and water, where cost-effective and appropriate.	The ORNL updated Metering Plan has been completed and is included as "Appendix C" per Office of Science (SC) guidance.	Continued implementation of metering plan will allow progress toward building level metering of all commodities.	Low
2.4	At least 15% (by building count or GSF) of existing buildings greater than 5,000 GSF to be compliant with the revised Guiding Principles for HPSB by FY 2025, with progress to 100% thereafter.	ORNL has established an HPSB inventory of 25 buildings, exceeding the 15% goal.	Efforts will continue toward expanding the existing HPSB inventory.	Low
2.5	Efforts to increase regional and local planning coordination and involvement.	Progress documented in Section 2.5.	Continue participation in local an regional transportation and sustainability organizations.	Low

SSPP Goal #	DOE Goal	Performance Status through FY 2015	Planned Actions & Contribution	Risk of Nonattainment
2.6a	Net Zero Buildings: Percentage of the site's existing buildings (>5,000 GSF) intended to be energy, waste, or water net-zero buildings by FY 2025.	Progress documented in Section 2.6a.	See details in Section 2.6a.	
2.6b	Net Zero Buildings: Percentage of new buildings (>5,000 GSF) entering the planning process designed to achieve energy net-zero beginning in FY 2020.	Progress documented in Section 2.6b.	See details in Section 2.6b.	
2.7	Data Center Efficiency. Establish a power usage effectiveness target in the range of 1.2-1.4 for new data centers and less than 1.5 for existing data centers.	In FY 2015 ORNL Data Centers experienced a portfolio average PUE of 1.28, exceeding the goal of 1.5.	Continue to optimize systems to meet or exceed goals. Engineering staff have identified several areas to pursue additional energy savings.	Low
Goal 3: Clean and Renewable Energy				
3.1	"Clean Energy" requires that the percentage of an agency's total electric and thermal energy accounted for by renewable and alternative energy shall be not less than: 10% in FY 2016-2017, working towards 25% by FY 2025.	The purchase of RECs for the Renewable Energy Target results in achieving a benchmark of 8% of the Clean Energy Target, as it readies to meet the targets in future years.	Purchase additional RECs, beyond the Renewable Energy Target, to meet and/or exceed the Clean Energy interim target of 10% in FY 2016.	Low
3.2	"Renewable Electric Energy" requires that renewable electric energy account for not less than 10% of a total agency electric consumption in FY16-17, working towards 30% of total agency electric consumption by FY 2025.	ORNL has purchased RECs to supplement on-site renewable energy generation to achieve 11.2% of electrical energy to be from renewable resources, exceeding the interim 7.5% goal.	Purchase sufficient RECs to off-set the on-site renewable energy generation and the TVA Southeastern Pilot Program RECs to meet and/or exceed the interim goal in FY 2016.	Low
Goal 4: Water Use Efficiency and Management				
4.1	36% potable water intensity (Gal/GSF) reduction by FY 2025 from a FY 2007 baseline (2015 target: 16%).	Water use intensity measured 132 G/GSF in FY 2015 (a reduction of 25% to date, exceeding the interim goal).	Continue to evaluate water conservation opportunities and identify and repair leaks on an aging distribution system.	Low
4.2	30% water consumption (Gal) reduction of industrial, landscaping, and agricultural (ILA) water by FY 2025 from a FY 2010 baseline (2015 target: 10%).	No ILA water use at ORNL.	No ILA water use at ORNL.	N/A
Goal 5: Fleet Management				
5.1	20% reduction in annual petroleum consumption by FY 2015 relative to a FY 2005 baseline; maintain 20% reduction thereafter. (2015 target: 20%).	In FY 2015 ORNL achieved a 57% reduction in cumulative petroleum consumption relative to the FY 2005 baseline, exceeding the DOE target.	Continue to use alternative fuel and continue to educate drivers about the importance of using alternative fuels in flex fuel vehicles to meet new EO 13693.	Low

SSPP Goal #	DOE Goal	Performance Status through FY 2015	Planned Actions & Contribution	Risk of Nonattainment
5.2	10% increase in annual alternative fuel consumption by FY 2015 relative to a FY 2005 baseline; maintain 10% increase thereafter. (2015 target: 10%).	In FY 2015 ORNL achieved a 227% increase in cumulative alternative fuel consumption relative to the FY 2005 baseline, exceeding the DOE target of 160%.	Continue to use alternative fuel. Continue to ensure biodiesel quality is maintained.	Low
5.3	30% reduction in fleet-wide per-mile GHG emissions reduction by FY 2025 from a FY 2014 baseline. (2015 target: N/A; 2017 target: 4%).	Determine the 2014 GHG baseline for ORNL using final guidance and data to be provided by DOE (FEMP).	ORNL plans to support the GHG emission initiative through purchasing PHEVs.	Low
5.4	75% of light duty vehicle acquisitions must consist of alternative fuel vehicles (AFV). (2015 target: 75%).	100% of the light duty vehicles purchased in FY 2015 were AFVs.	Continue to purchase AFVs from General Services Administration schedules as funds and approvals are provided.	Low
5.5	50% of passenger vehicle acquisitions consist of zero emission or plug-in hybrid electric vehicles by FY 2025. (2015 target: N/A).	N.A. for FY 2015. Note: ORNL has purchased 3 PHEVs and has EV charging infrastructure in place on campus and satellite locations (44 charging stations).	Prepare for new FY 2025 targets and other new EO and DOE directives.	
Goal 6: Sustainable Acquisition				
6.1	Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring BioPreferred and biobased provisions and clauses are included in 95% of applicable contracts.	100% of all applicable contracts in FY 2015 contained terms and conditions that invoke requirements for sustainable acquisitions.	As indicated in EO 13693, three FAR clauses will be added to the standard Commercial Items Terms and Conditions contracts beginning in January, 2016.	Low
Goal 7: Pollution Prevention and Waste Reduction				
7.1	Divert at least 50% of non-hazardous solid waste, excluding construction and demolition debris.	A 49% diversion rate was achieved in FY 2015. While less than the target, this represents a significant improvement in the past year.	Continue mitigation measures and process improvements to close the gap for this goal in FY 2016 and beyond.	Medium
7.2	Divert at least 50% of construction and demolition materials and debris.	ORNL's diversion rate for construction and demolition debris for FY 2015 is 88%, exceeding the target.	Continue process improvements. Additional focus will be placed on segregation of waste.	Medium
Goal 8: Energy Performance Contracts				
8.1	Annual targets for performance contracting to be implemented in FY 2017 and annually thereafter as part of the planning of Section 14 of EO 13693.	Progress documented in Section 8.1.	Existing ESPC in place wih JCI through FY 2031.	Low

SSPP Goal #	DOE Goal	Performance Status through FY 2015	Planned Actions & Contribution	Risk of Nonattainment
Goal 9: Electronic Stewardship				
9.1	Purchases – 95% of eligible acquisitions each year are EPEAT-registered products.	Exceeded the 95% goal in FY 2015.	Continue with guided procurement to assure compliance. Closely monitor non-standard requests for electronic requisitions.	Low
9.2	Power management – 100% of eligible PCs, laptops, and monitors have power management enabled.	100% of eligible computers, monitors, and laptops are being actively power managed.	Continue to actively ensure all eligible computing equipment is power managed.	Low
9.3	Automatic duplexing – 100% of eligible computers and imaging equipment have automatic duplexing enabled.	Successful implementation of program to ensure all new print services include automatic duplexing set as default.	Update print management documents and strategy with respect to the DOE *Sustainable Print Management Guide* once the guide is finalized.	Low
9.4	End of Life – 100% of used electronics are reused or recycled using environmentally sound disposition options each year.	100% of dispositioned electronics equipment is reused or recycled using CFL and R2 certified reuse/recycle practices.	Continue to dispose of electronics equipment using CFL and R2 certified reuse/recycle practices.	Low
Goal 10: Climate Change Resilience				
10.1	Update policies to incentivize planning for, and addressing the impacts of climate change.	Progress documented in Section 10.1.	CCR Team continues to review, update, and implement policies as needed.	Low
10.2	Update emergency response procedures and protocols to account for projected climate change, including extreme weather events.	Progress documented in Section 10.2.	CCR Team working directly with subject matter experts to ensure that procedures and protocols are reviewed and updated as needed.	Low
10.3	Ensure workforce protocols and policies reflect projected human health and safety impacts of climate change	Progress documented in Section 10.3.	CCR Team working directly with subject matter experts to ensure that procedures and protocols are reviewed and updated as needed.	Low
10.4	Ensure site/lab management demonstrates commitment to adaptation efforts through internal communications and policies.	Progress documented in Section 10.4.	ORNL management continues to be engaged and to communicate policy updates.	Low
10.5	Ensure that site/lab climate adaptation and resilience policies and programs reflect best available current climate change science, updated as necessary.	Progress documented in Section 10.5.	Ongoing process for the CCR Team and subject matter experts.	Low

2008
2009
2010
2012
2013
2014
2015

II. Performance Review and Plan Narrative

GOAL 1: GREENHOUSE GAS REDUCTION

1.1 GHG Reduction—Scope 1 & 2

DOE Goal: 50% Scope 1 & 2 GHG reduction by FY 2025 from a FY 2008 baseline. (FY 2015 target: 19%).

In March 2015 Executive Order (EO) 13693, *Planning for Federal Sustainability in the Next Decade*, was issued to recommit all federal agencies to leadership in sustainable practices and operations and to increase commitments in the reduction of greenhouse gas (GHG) emissions: "Federal leadership in energy, environmental, water, fleet, buildings, and acquisition management will continue to drive national greenhouse gas reductions and support preparations for the impacts of climate change." The new EO directed all agencies to develop more aggressive GHG reduction plans and targets over the next 10 years. The US Department of Energy (DOE) committed to a 50% reduction target in Scope 1 and Scope 2 GHG emissions by Fiscal Year (FY) 2025 and a 25% reduction target for Scope 3 GHG emissions. As with the previous executive order regarding GHG emissions (EO 13514), the reduction targets in EO 13693 are relative to a baseline year of FY 2008.

ORNL's Sustainable Campus Initiative (SCI) continues its drive to integrate the sustainability message into organizational processes and procedures. Through employee engagement efforts, personnel have become more aware of how daily actions and facility operations can be modified to reduce carbon emissions. All of the individual sections of this plan will discuss strategies and tactics that will lead to the reduction of carbon emissions. In addition, process improvement plans currently being developed in a number of divisions will work together to promote sustainability and GHG emissions by source (covering all scopes), resulting in improved performance toward the attainment of site sustainability plan (SSP) goals.

As is the case with most DOE operational locations, ORNL's greatest source of GHG emissions is the result of purchased electricity—the primary contributor of Scope 2 emissions—something over which we have little control. One of our most proactive endeavors in this area is working with the Tennessee Valley Authority (TVA), our regional electrical power provider, to encourage and support cleaner power generation practices that reduce carbon emissions whenever possible.

Performance Status

In FY 2015 ORNL leadership, the SCI, and the Facilities and Operations (F&O) Directorate continued to focus on effective strategies for the reduction of Scope 1 & 2 GHG emissions. Sustainable building practices, planning for efficient space management, and energy conservation efforts are foremost in strategic initiatives that result in energy efficiency and the management of carbon emissions. In FY 2015 the high-energy mission-specific facilities (HEMSFs) consumed 71% of ORNL's electrical energy and 52% of all ORNL water and current projections show an increase in both utility areas by FY 2025. As ORNL anticipates and plans for increase in campus growth, development is expected to be in the form of energy-efficient facilities, and efforts to transition from older, less-efficient facilities will continue in order to optimize campus energy consumption. Additional details follow in the paragraphs below.

ORNL aggressively strives to have a positive influence on achieving the overall DOE goal of a 50% reduction target for total Scope 1 and Scope 2 GHG emissions. The GHG table shows the FY 2015 Scope 1 and 2 GHG emissions inventory by source, and the associated graph shows the total FY 2015 ORNL Scope 1 and 2 emissions performance compared to that of FY 2008. Major factors in the GHG inventory include the following for FY 2015 performance:

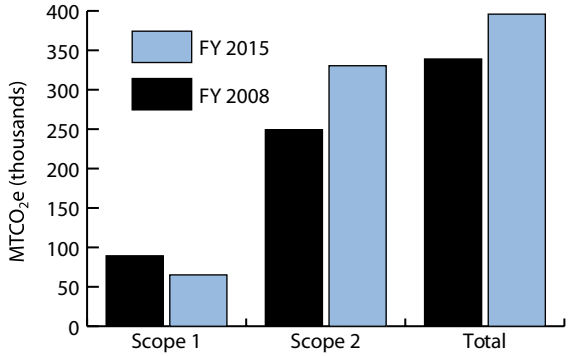
- Scope 1 GHG estimate is 65,388 metric tons of CO_2 equivalents ($MTCO_2e$), a decrease of 27% from the FY 2008 baseline. Scope 1 reductions are on target due to previously implemented energy conservation measures (ECMs), the results from the Johnson Controls, Inc. (JCI) energy savings performance contract (ESPC) implementation, and reductions in operational process emissions.
- Scope 2 GHG emissions totaled 374,797 $MTCO_2e$ before renewable energy credits (RECs). Purchased RECs resulted in avoidance of 44,332 $MTCO_2e$ in GHG emissions, reducing the FY 2015 Scope 2 GHG estimate to 330,465 $MTCO_2e$, an increase of 33% over FY 2008. This increase in Scope 2 emissions is the result of growth in purchased electricity due to increases in the critical research mission of ORNL since the baseline year. The FY 2015 combined total of Scope 1 and 2 estimates is 395,853 $MTCO_2e$, an overall increase of 17% from FY 2008.
- Sulfur hexafluoride (SF_6) process losses decreased greatly from the baseline as plans for the decommissioning of the Holifield Radioactive Ion Beam Facility (HRIBF) continued to develop. (See SF_6 Progress below).
- Purchased electricity continued to grow as important mission facilities, such as world-class research in computational programs, continues to expand.
- To help offset the growth of GHG emissions from electricity, RECs totaling 66,000 MWh from renewable energy resources were purchased.

SF_6 Progress

SF_6 is a key contributor to ORNL's Scope 1 GHG emissions inventory. Active management of SF_6 emissions will be necessary to meet DOE's overall reduction goal of 50% for Scope 1 GHG emissions. An overall awareness of the global warming potential of SF_6 has resulted in a more cautious approach to the requisition and purchase of this potent GHG. ORNL is committed to evaluating processes and purchasing improvements with the potential to reduce SF_6 emissions.

The HRIBF tandem accelerator SF_6 inventory at the end of FY 2015 was approximately 204,700 lb. Losses during the year were normal process losses totaling 1,766 lb, which is less than the facility baseline of 2,500 lb/year as established as part of the ORNL FY 2008 GHG baseline analysis. Normal process losses differ from year to year due to a variety of factors, including the number of SF_6 transfer cycles to and from storage, operating temperatures, and pressures, and to the amount of recirculation of the gas in the accelerator. The SF_6 process loss in FY 2015 is calculated at 18,264 $MTCO_2e$ (from estimated releases of 1,766 lb), a 33% reduction from the FY 2008 baseline.

As of the end of FY 2015, the tandem accelerator operation remained unfunded by the DOE Office of Nuclear Physics. However, limited accelerator operation continues on a full-cost-recovery basis, and the accelerator is being maintained in a safe and secure condition. All surveillance and maintenance activities associated with the tandem accelerator and the SF_6 gas-handling system continue as normal. In addition, facility staff members continually evaluate the potential for further loss reductions, including simplification of the gas-handling system, refurbishment of compressors, and elimination of potential single-point failures.



ORNL FY 2015 Performance

ORNL Scope 1 and Scope 2 GHG emission inventory (FY 2015 compared to the FY 2008 baseline)				
Scope 1 GHG emissions ($MTCO_2e$)	FY 2008	FY 2015	Increase (Decrease)	Change (%)
Natural Gas, Facilities	48,563	40,144	(8,419)	–17
SF_6 Process Losses	27,102	18,264	(8,838)	–33
Fugitive Gases	10,660	2,991	(7,669)	–72
Fuel Oil, Facilities	1,968	2,932	964	+49
Fleet Fuels	1,104	805	(299)	–27
Minor Sources	203	252	49	+24
Total Scope 1 GHG Emissions	**89,600**	**65,388**	**(24,212)**	**-27**
Scope 2 GHG Emissions	FY 2008	FY 2015	Increase (Decrease)	Increase/ Decrease (%)
Purchased Electricity	249,407	374,797	125,390	+50
Purchased RECs - GHG Avoided	—	(44,332)	(40,332)	--
Net Annual Scope 2 GHG Emissions	**249,407**	**330,465**	**81,058**	**+33**
Scope 1 and Scope 2 GHG Emissions	FY 2008	FY 2015	Increase (Decrease)	Increase/ Decrease (%)
Combined GHG Calculation	**339,007**	**395,853**	**56,846**	**+17**

Plans and Projected Performance

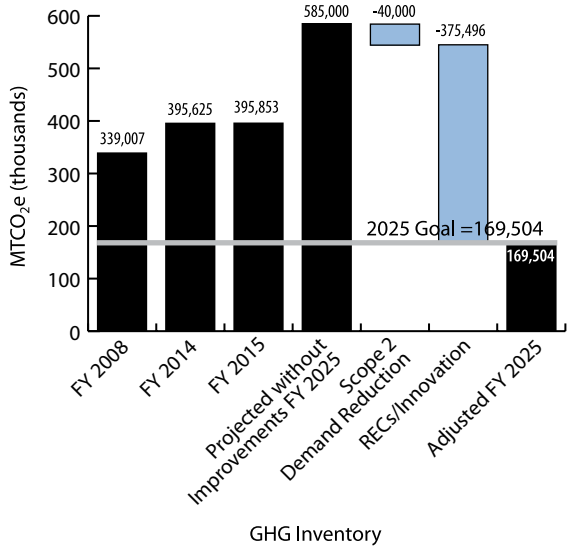
Scope 1 GHG projections. Scope 1 reduction estimates indicate that ORNL is on target to meet the FY 2025 target reduction goal of 50%. This projected success is based on a number of key projects and initiatives, summarized below:

- Natural gas and fuel oil purchases for facilities are expected to decrease with the commissioning of a more efficient steam system, which was commissioned in September 2015.
- SF_6 process losses at HRIBF are expected to decline as the tandem accelerator research operation is not currently funded. Plans are being developed for the safe and reliable transfer of the remaining SF_6 inventory.
- The results of ECMs and energy audits managed by the Facilities Management Division (FMD) will provide continuous incremental progress toward the FY 2025 goals.
- Nonprocess fugitive emissions should continue to decline as research scientists are made aware of less potent alternatives for tracer gases and laboratory research.

Scope 2 GHG projections. Scope 2 reductions represent a tremendous challenge due to continued growth in electricity demands for mission-critical facilities such as the Spallation Neutron Source (SNS). The importance of ORNL's HEMSFs and the associated electricity that the facilities are projected to consume are detailed in Section V of this report. Factors that influence Scope 2 reduction measures include the following:

- Purchased electricity will grow as critical mission facilities expand to meet national research demands.
- Renewable and clean energy studies will be developed, and on-site projects will be implemented when economically feasible. The acquisition of RECs with the appropriate environmental attributes will be utilized as a strategy to mitigate GHG emissions when on-site renewable and clean energy projects are not cost-effective.
- ECMs and other energy improvement projects will provide Scope 2 demand reductions and will combine for incremental relief during the performance period.
- The DOE cost-sharing agreement aimed at promoting small modular reactor (SMR) clean energy technology will be a significant factor in the reduction of Scope 2 GHG emissions for ORNL.
- Viable clean energy projects are being explored at this time, and potential transformation technologies will continue to be studied as they are developed.
- As ORNL's electrical power provider, TVA has committed to a number of initiatives that serve to reduce carbon emissions and to moderate the need for coal consumption during times of peak power demand. As a federal entity, TVA is also expected to play a role in federal leadership in EO 13693 goals. Recent annual reports show that decreases in carbon emissions are being realized and that the US Enrironmental Protection Agency (EPA) *Emissions and Generation Resource Integrated Database* (eGRID) rate for the TVA region continues to improve. As the TVA GHG output emissions improve, improvements in ORNL's Scope 2 GHG emissions performance will follow. TVA's current carbon emission rate is 1,007 lb/MWh, lower that the eGRID national average of 1,232 and the regional average of 1,389. As the improvements in TVA clean power are eventually validated and included in future versions of eGRID tables, our regional Scope 2 emissions will continue to improve.

ORNL's updated Scope 1 and 2 waterfall chart is used to demonstrate the need for innovative and transformational technologies to help DOE realize the 50% reduction target for Scope 1 and 2 GHG emissions. The purchase of RECs will be used to temper the growth in Scope 2 emissions while renewable and clean energy projects continue to be evaluated.



ORNL Scope 1 and 2 GHG Reduction Plan

Scope 1: Direct Emmissions (Natural Gas, SF_6, Fleet Vehicles, Stacks, Hoods)

Scope 2: Purchased Electricity

Scope 1 & 2 FY 2025 Target: 50% reduction from FY 2008 baseline

1.2 GHG Reduction—Scope 3

DOE Goal: 25% Scope 3 GHG reduction by FY 2025 from a FY 2008 baseline (FY 2015 target: 6%).

By definition, Scope 3 GHG emissions include those activities that organizations can influence but not control by business processes alone. As with the Scope 3 emissions at most other federal workplaces, the emissions at ORNL are attributed to the following activities at the site:

- transmission and distribution (T&D) losses from purchased electricity,
- employee workplace commutes,
- employee business air travel, and
- employee business ground travel.

ORNL continues its overall commitment to communications aimed at employees to encourage their engagement in GHG reduction. Influencing the actions of employees and their awareness of how those actions affect the carbon footprint of the organization is one of the foundational methods to achieve a more sustainable future. Employee outreach interactions are designed to focus efforts on the reduction of direct and indirect emissions in all actions. Communication is designed to reach management, employees, and contractors to encourage sustainable practices in the workplace, at home, and in the community.

Performance Status

In FY 2015 the management of the SCI program continued to be the primary driver for the overall reduction of Scope 3 GHG emissions. Initiatives that work together to reduce indirect emissions include employee commuting, sustainable transportation, and an improved, accessible, and promotion of video teleconferencing programs for the avoidance of business travel (whenever possible). ORNL continues to partner with Smart Trips promoting employee carpooling. Smart Trips provides driving incentives and ORNL provides designated parking spaces for those staff members who carpool. A huge, new endeavor for ORNL in FY 2015 was the addition of bus transit provided between ORNL, UT, and PSCC. ORNL partnered with UT and PSCC offering three roundtrip routes each day allowing staff, students, and faculty free transportation to each of these campuses. Only positive responses have been received from the transit ridership. Continued promotion for telework is ongoing at ORNL and SCI captures data from Human Resources and Information Technology (IT) organizations. During the inclement weather, over 1,000 staff members teleworked from their homes. No formal surveys were distributed to staff in FY 2015 but plans are to distribute an employee survey in FY 2016. In FY 2015, SCI sponsored a focused promotion effort to increase waste reduction and a significant increase was achieved—49% waste diversion reduction rate for FY 2015 improving from a 35% waste diversion reduction rate in FY 2014. There are no Scope 3 emissions to report for ORNL leased space. However, SCI will continue to work closely with ORNL's Real estate organization promoting the new guidance found in EO 13693.

The FY 2015 Scope 3 GHG emissions estimate is 44,440 $MTCO_2e$. Overall the Scope 3 inventory grew by 8% from the FY 2008 baseline. Scope 3 performance indicators demonstrate that while the employee commutes, business air travel, and business ground travel categories have all improved, a 33% growth in T&D losses limits the overall performance.

At the end of FY 2015, the ORNL employee workforce had experienced a 5% increase since the FY 2008 baseline year. Even with more employees, reductions have been made in Scope 3 GHG emissions attributable to employee commuting and business travel. These achievements are due to strong engagement with employees, management, and regional resources aimed at encouraging carpooling, ride shares, alternative work arrangements, and responsible business travel. While most Scope 3 categories have shown impressive improvements, a 33% increase in T&D losses (associated with the increase in purchased electricity) has limited overall performance to date.

ORNL's 25 Solar EV Charging Stations

ORNL Scope 3 GHG emission inventory (FY 2015 compared to the FY 2008 baseline)				
Scope 3 GHG Emissions ($MTCO_2e$)	FY 2008	FY 2015	Increase/Decrease	Change (%)
T&D Losses	16,429	21,769	+5,340	+33
Employee Commutes	16,193	15,663	–530	–3
Business Air Travel	7,204	6,168	–1,036	–14
Business Ground Travel	1,169	840	–329	–28
Other	44	—	–44	—
Total Scope 3	**41,039**	**44,440**	**+3,401**	**+8**

SCI members have continued to successfully work on issues such as incentives for carpooling and the advancement of management commitment to alternative work schedules at ORNL. Efforts have been initiated to develop mechanisms to track the number of people who are teleworking, using alternative workweek arrangements, and making use of teleconferencing to avoid business travel. Programs include the following:

Employee Commuting Options and Carpool Promotion and Participation. ORNL continues its partnership with Smart Trips, a program of the Knoxville Transportation Planning Organization. As a result of the outreach and promotional efforts, 78 ORNL employees logged commute alternative entries into the Smart Trips system in 2015. ORNL continues to promote sustainable employee commuting practices. Examples include the provision of Solar Assisted Electric Charging parking spots available for employee vehicles as well as ORNL fleet plug-in vehicles and preferred parking spaces for registered employee carpools.

EV Charging Stations. ORNL is a leader in the region in promoting electric vehicle (EV) use and has been actively participating in regional workplace charging efforts. A total of 44 electric vehicle supply equipment (EVSE) charging stations are available at ORNL's main campus and the Hardin Valley Campus. ORNL has 25 solar charging stations and 19 non-solar charging stations which includes one DC Fast charger. Currently, there are 39 employee-owned EV drivers and ORNL's Fleet Program has 3 EVs. ORNL is using telematics to monitor a Fleet EVSE vehicle—Ford CMAX Energi to determine charger use by collecting charging data from the ORNL EVSE chargers.

Alternative Work Schedules. ORNL Human Resources reported that 166 employees were on compressed work week schedules: 66 working a 9/80 shift (80 hours in 9 working days as opposed to the typical 10 days), and another 38 working a 4/10 shift (four 10-hour days each week as opposed to the typical five 8-hour day week), and 62 employees have established formal telework agreements (working one or more days from home each week). ORNL introduced the business quarter (BQ) shift in FY 2015, and due to the current payroll system in place by adopting this new BQ shift, there is no method to track if salaried, exempt staff members, may be working compressed schedules within the BQ. The SCI team will continue to work with Payroll and IT to include a telework designation in the payroll system when feature upgrades are introduced. To encourage teleworking official telework policies were developed. SCI worked with Human Resources to promote the new policy. In addition, ORNL is leading an effort on telework best practices, partnering with five other DOE labs.

Business Travel. ORNL has experienced a reduction in business air and ground travel due to a better awareness of the benefits of conservative travel and improved teleconferencing tools. ORNL continues to emphasize the benefits of conservative conference travel, environmentally friendly practices such as carpooling or taking public transportation while on business travel, and the added benefits of the use of teleconferencing tools whenever practical. Since the implementation of the BlueJeans videoconferencing system this tool has proven effective in managing business travel. In the last 12 months of operation, 11,040 teleconference meetings were held involving 42,939 participants, resulting in the avoidance of the financial and environmental costs of traditional business travel. A satisfied ORNL user stated

> *"Through BlueJeans, I can hold video-based information sessions about ORNL with students at various college campuses…The students feel connected because I am able to provide personal interaction, and I benefit from enhanced recruitment outreach and lower recruitment travel costs".—Student Recruiter*

Support for Cyclists and the Multimodal Access Plan
ORNL is preparing for new goals related to the multimodal access plan (MAP) for commuters as directed in EO 13693. ORNL continues to promote ride sharing and other multiple-occupancy employee commuting options as well as biking to work when applicable. Many of the ORNL main campus and satellite campus locations provide access to showers, lockers, and bicycle storage.

Plans and Projected Performance

Because of the nature of Scope 3 emissions and the fact that such emissions are beyond the direct control of organizations, reductions are dependent upon strong communications with employees and regional partners. At ORNL, SCI, using employee engagement, is the primary tool to ensure progress toward Scope 3 reductions related to employee commutes and business air and ground travel. The rural setting of ORNL is a barrier to the development of public transportation options; therefore, a key for SCI is to continue promoting innovative commuting options and alternative work schedules. ORNL is committed to reducing Scope 3 GHG emissions. The following efforts are currently underway to help meet the Scope 3 GHG reduction goals.

Efforts related to employee transportation and commuting

ORNL will continue to maximize transportation options and community outreach by coordinating with local, state, and federal telecommute and rideshare agencies, including further development of regional transportation planning partnerships such as Smart Trips. The Laboratory will also continue its employee outreach and education programs to increase participation in commuting options and telework alternatives, including maintaining and updating promotional tools and websites to assist employees in making informed decisions. Plans are in place to further prepare for new EO 13693 goals and the MAP for commuters. See Section 2.5 of this report, "Regional and Local Planning," for more details regarding ORNL involvement in regional and local planning and coordination efforts for commuters.

Efforts related to business air travel and business ground travel

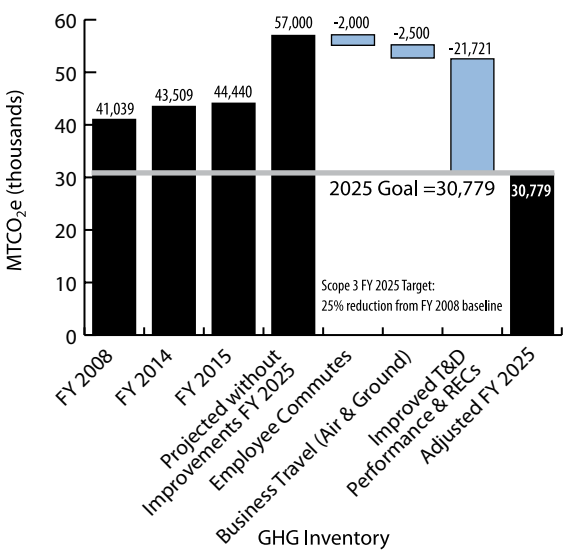
Several federal, DOE, and ORNL travel initiatives emphasize the overall benefits of reduced business travel. Travel policies aimed at reducing cost also lead to more efficient use of time and lessen GHG emissions by curtailing the use of travel-related fuels. ORNL will continue to promote the initiatives that have resulted in the current successes in this Scope 3 performance area by evaluating advanced technologies such as the Blue Jeans Videoconference tool.

T&D loss–related efforts
As we approach the FY 2025 target year, the ORNL research missions will continue to grow, and GHG emissions attributed to T&D losses from purchased electricity are expected to increase. The cost-effective acquisition of RECs with the appropriate environmental

New ORNL electricity substation, completed in FY 2015

attributes will also be utilized as a strategy to mitigate Scope 3 GHG emissions. The reduction of GHG emissions resulting from T&D losses is dependent upon our engagement with TVA to work in tandem to establish clean power production goals and to upgrade the T&D infrastructure. ORNL has a strong working relationship with TVA, and both the DOE Oak Ridge Site Office and ORNL have taken steps to strengthen those bonds in recent years. To reduce T&D losses and improve the reliability of medium-voltage distribution, a new on-site electricity substation was completed this year to serve the high-energy computational research load. ORNL is involved in many planning and working committees with TVA. The Laboratory has taken a proactive position and included TVA as a key member of its solutions team for cleaner electrical grid emissions, which will also reduce T&D losses.

ORNL's updated Scope 3 waterfall chart is used to demonstrate the current gap in the 25% reduction target goal. Improved T&D performance and the Scope 3 benefits of REC purchases will be the primary tools needed to reach the new goals by the target year of FY 2025.



GOAL 2: SUSTAINABLE BUILDINGS

2.1 Energy Intensity Reductions

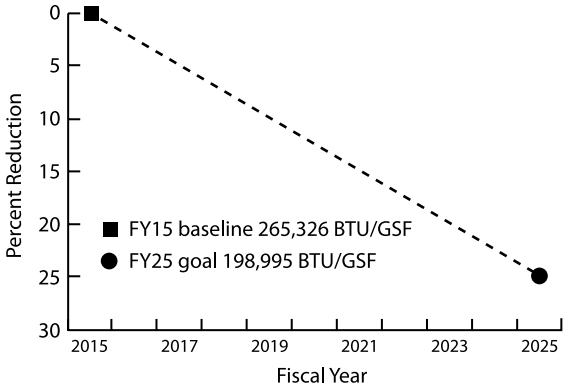
DOE Goal: 25% energy intensity British thermal unit/gross square footage (Btu/GSF) reduction in goal-subject buildings, achieving 2.5% reduction annually, by FY 2025 from a FY 2015 baseline. (FY 2015 target: Establish Baseline).

Performance Status

ORNL made steady progress toward meeting the previous 30% energy use intensity (EUI) goal from EO 13514. As directed by EO 13693, a new baseline has been developed for FY 2015 to further EUI reduction efforts to meet or exceed the new goal of a 25% reduction by FY 2025. The FY 2015 EUI has been calculated at 265,326 Btu/GSF with a goal to achieve the target of 198,995 Btu/GSF by FY 2025, using 2.5% annual target reductions.

ORNL will continue with a best practices methodology in the construction of energy-efficient new facilities, repurposing existing facilities to better align with mission and resources for effective operations, and demolition of inefficient legacy facilities. Aggressive energy reduction activities in current facilities will be combined with ongoing audits and the ECM program, new efforts in building commissioning, benchmarking energy consumption, and best management practices.

Based on FY 2015 data, energy use in the buildings category at ORNL is 1,367 billion Btu, not including ORNL's excluded facilities as defined by the Energy Policy Act of 1992 (EPACT). Given an area of 5,153,191 GSF of energy-consuming buildings, trailers, and other structures/facilities identified in the Facilities Information Management System (FIMS), the FY 2015 calculated EUI is 265,326 Btu/GSF.



ORNL FY 2015 EUI

Plans and Projected Performance

ORNL made significant progress in EUI reduction by driving toward the previous goal ending in FY 2015. Now, with an FY 2015 baseline established and sights set on the new EO 13693 goal, ORNL will position itself to be successful in sustained performance improvements. This objective will be supported by the continued operation of the ECMs implemented by the JCI ESPC and by the ORNL integrated, in-house energy management program.

An ESPC with JCI is a significant component of ORNL's energy management strategy. The delivery order with JCI was awarded in July 2008 and was accepted in July 2012. Positive results from this ESPC will continue to be experienced into the future. The ESPC ECMs included steam system decentralization, lighting upgrades, water conservation, building management system improvements, mechanical equipment upgrades, and steam production improvements.

Other ESPC improvements include the building management system ECM modernized heating, ventilating, and air-conditioning (HVAC) control systems which provided the means to significantly reduce or eliminate energy intensive simultaneous heating and cooling in several large air-handling units.

Upgrades to the Steam Plant, ORNL's New Dual-Fuel Boilers

The Biomass Gasification Steam System experienced operational difficulties in September 2013. JCI replaced that system with a dual-fuel natural gas/fuel oil boiler, commissioned in September 2015. ORNL also installed two similar boilers to further enhance the steam system efficiency by replacing two existing, less-efficient vintage boilers.

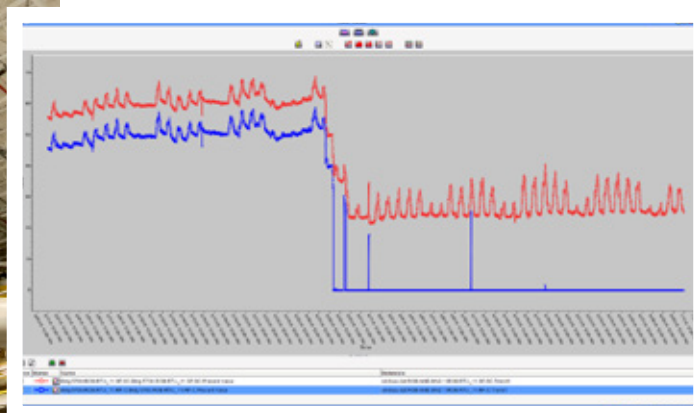
In-House Energy Management

ORNL's in-house energy management strategy revolves around utility meter data with a "measure-to-manage" philosophy. These meter data provide the basis for benchmarking, which sets priorities for energy auditing. Energy audits identify ECMs that include building envelope repairs, high-efficiency equipment upgrades, and HVAC control system optimization. Existing building commissioning efforts have proven beneficial for realizing energy savings potential by adjusting parameters of existing systems, consistent with current usage conditions. To sustain the resulting performance and savings achievements, ongoing commissioning leverages utility meter and building automation system data for monitoring trends and identifying anomalies.

Recommissioning and Improvements in HVAC Performance

A project to boost further reductions is the recently completed recommissioning project that reduced HVAC airflow and energy consumption by 40% in a 140,000 ft^2 office building. This building was observed to have supply air-flow rates that drove excessive reheat use. Energy and facility personnel approached this challenge by reevaluating the airflow volume to each office and reducing many of them; sometimes by 50% or more. These lower air volumes created energy savings by allowing supply air fans to slow down and reduce demand for heating and cooling of HVAC supply air. The provided graphic demonstrates the supply and return fan speed trend. Left side of graphic is baseline speed and right side of graphic is post commissioning, reduced speed.

New dual-fuel boilers enhance steam system efficiency



Lower air volumes create energy savings

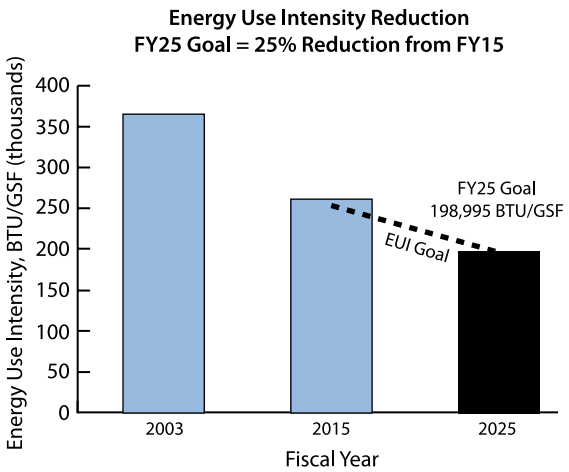
Central Campus Chiller Rebuild

Another example of ORNL's dedication to energy conservation is the rebuild of a chiller on central campus. The project cost was $111,000 and resulted in electrical savings of $35,000/year based on the 10% efficiency improvement. This project will facilitate energy savings and continue EUI reductions in the upcoming target years.

Additional Energy Reduction Opportunities

Demand reduction opportunities are being considered to shift selected loads to off-peak periods for electrical energy cost savings as ORNL transitions to a time-of-use electrical energy rate structure in FY 2016. Installation of additional solar arrays have also been considered to reduce peak demand for additional electrical energy savings and to increase ORNL's on-site renewable generation.

Persistent savings from ECMs and aggressive energy innovation in the construction, repurposing, and renovation of buildings have resulted in the new EUI baseline for FY 2015 of 265,326 Btu/GSF. The continued dedication to energy conservation is expected to help meet or exceed the 25% reduction target in FY 2025 (198,995 Btu/GSF).



Central campus chiller rebuild project

2.2 EISA Section 432 Energy and Water Evaluations

DOE Goal: EISA Section 432 energy and water evaluations, benchmarking, project implementation, and measures follow-up.

Performance Status

ORNL has made good progress on the energy audit program, having completed the third year of another four-year cycle in FY 2015. Section 432 of the 2007 Energy Independence and Security Act (EISA) requires that 25% of 75% of facility energy use be audited each year, with audits repeated on a four-year cycle. Note: evaluation by an energy service company for a site-wide initial proposal in preparation for an ESPC is acceptable as fulfilling this four-year requirement.

The ESPC evaluation in FY 2008 by JCI provided the first 100% audit of the ORNL campus. In FY 2009 ORNL chose to proceed with a second round of audits, although doing so was not required at that time because of the JCI initial proposal, to provide additional detail on potential ECMs that could be carried out using in-house operating staff and funds. The audits also provided a ready list of ECMs in the event that supplemental funds became available. This second round of audits (completed in FY 2012) evaluated 3.2 million ft^2 of building space.

In FY 2013 ORNL began a new audit cycle and elected to modify the associated statement of work to focus on specific energy and water use issues and avoid duplication of work conducted during the previous rounds. This approach has proven to be very successful in identifying HVAC optimization opportunities that require only minor capital modifications and use intelligent control sequences of operation to maximize the potential of existing systems. In many cases, these audits serve as the first phase of an existing building commissioning process and as a foundation for follow-on efforts.

Recommended energy and water conservation measures from all audits are compiled on a composite list for prioritization, tracking, and periodic reevaluation to verify that they are still pertinent. Primary prioritization is ordered by life-cycle cost and benefit analyses, but secondary factors are also taken into consideration to facilitate alignment with current opportunities and to identify measures that have the best potential for implementation.

Plans and Projected Performance

In FY 2016 ORNL will take a graded approach to energy auditing using American Society of Heating, Refrigerating and Air-Conditioning Engineers audits as well as remote building analytics. Specific emphasis will continue to be applied to ensuring the quality and feasibly of recommended energy and water conservation measures. In addition to these audits, ORNL will engage in-house facility managers and facility engineers to identify lighting, building envelope, and other energy conservation measures that become apparent through the course of their daily functions. By quantifying the energy economics associated with these opportunities, ORNL's sustainability and energy efficiency personnel will aid facilities personnel in the organization and prioritization of these items to promote the attention that they deserve.

Continued focus will be placed on improving the breadth and depth of ORNL's benchmarked building portfolio. The EPA ENERGY STAR Portfolio Manager currently contains many meter datasets for ORNL buildings, but efforts to improve the continuity of data and consistency of building profiles are under way. Capabilities within ORNL's Central Energy Data System (CEDS) are expected to be integral to streamlining and automating data flow to the ENERGY STAR Portfolio Manager.

ORNL Energy Audit Results in Annual Square Footage and Percentage of Campus

Year	Annual Square Footage	Annual Percentage of Campus	Cumulative Square Footage	Audit Company
2008	3,195,365	100.00	3,195,365	JCI (ESPC)
2009	1,294,069	40.50	4,489,434	V3
2010	627,382	19.63	5,116,816	Keres/EMG
2011	470,563	14.73	5,587,379	Keres/EMG
2012	775,596	24.27	6,632,975	Keres/EMG
2013	963,160	30.14	7,326,135	WorkingBuildings
2014	976,385	27.12	8,302,520	WorkingBuildings
2015	200,771	3.90	8,503,291	WorkingBuildings/ECT/ETSD

2.3 Metering for Individual Buildings

DOE Goal: Meter all individual buildings for electricity, natural gas, steam, and water; where cost-effective and appropriate.

ORNL created an updated site-wide metering plan that has been included as Appendix C to this SSP report, as directed by the current DOE SSP guidance. This metering plan is a comprehensive document that charts a course for ORNL's continued advanced metering deployment that is consistent with the *November 2014 Update to the Federal Building Metering Guidance*.

The ORNL metering plan utilizes the Federal Building "appropriateness" for metering and prioritization methodologies. This plan also details the estimated quantity of funding and personnel required for its implementation. Because the SSP guidance is cognizant of the new EO 13693 and federal financial stewardship, the term "where cost-effective and appropriate" indicates that locations for new meter installations will need to be carefully evaluated.

All advanced meters included in the metering plan will be connected to ORNL's CEDS for data archiving and analysis. This system has the ability to log multiple parameters from each meter on a standard 15-minute interval. This system also enables meter data trend analysis, report generation, energy awareness dashboard deployment, normalization for weather and other factors as well as data export for use in other analyses. A utility cost analysis and allocation module within the CEDS called "*EnergyCAP*" will be used to automate utility cost distribution, generate management reports, and push monthly energy data to EPA's ENERGY STAR Portfolio Manager for benchmarking.

Personnel charged with analysis of energy data will include the site energy manager, Utilities Division management, and F&O management. The energy manager will be responsible for processing energy data to make it actionable for F&O management who have operational control of energy-consuming buildings. The Utilities Division staff engineer in charge of energy cost accounting will process meter data to inform utility cost allocation, bill verification, and management reporting.

As with any project undertaking of this scale, continued meter deployment will not be without barriers. These barriers may include installation funding limitations, alternative prioritizations of installation labor force, utility outages or service interruptions required to accommodate installations, and technical challenges.

2.4 High Performance Sustainable Buildings Guiding Principles

DOE Goal: At least 15% of existing buildings greater than 5,000 GSF to be compliant with the revised GPs for HPSB by FY 2025, with progress to 100% thereafter.

Performance Status

ORNL's high performance sustainable building (HPSB) inventory totaled 25 buildings in FY 2015, all aligning with the *Guiding Principles (GPs) for Federal Leadership in Sustainable Buildings*.

Employing a systematic approach to identifying HPSB candidates and applying the GPs has proven effective in keeping us on track for continued progress. HPSB candidates have been identified based on building space use, existing metering infrastructure, and identified energy conservation opportunities. Action plans for achieving building-specific GPs are developed and executed while laboratorywide standards are used to fulfill HPSB applicable policies and procedures. Engagement of facility managers, facility engineers, and other technical personnel has been essential to acquiring quality benchmarking data, performing commissioning activities, and implementing energy conservation measures.

ORNL HPSB efforts have begun to shift from office buildings to include laboratory and mixed use buildings as experience with the GPs has grown. Significant efforts have been focused on evaluating the operation of existing systems and their suitability with respect to current facility use. Temperature and airflow setpoints and equipment operating sequences were examined with the intent to rightsize and achieve maximum efficiency potential from existing systems. Occupant comfort and known conditions were also taken into consideration for a holistic evaluation of building performance. Modifications were made to implement occupancy-based lighting control, and standardized occupant-controlled task lighting was found to align with the GPs.

While all of the GPs contribute to the betterment of buildings, the existing building commissioning process has proved most beneficial in identifying opportunities to optimize existing equipment and systems to better align with current space use. With the evolution of research programs and projects, buildings are often used in a manner that is different from their original designs. Because of this, identifying, evaluating, and adjusting HVAC airflow volumes, setpoints, and control sequences and related actions have proven to provide the best return on investment. ORNL realizes that achieving HPSB status is not the end but rather just the beginning of an ongoing cycle of "plan, do, check, act" to ensure the persistence of savings and potentially even increase them over time.

Plans and Projected Performance

Starting in FY 2016, ORNL will be evaluating the revised HPSB guidance that results from new directives in EO 13693. Building inventory will be assessed to determine the best compliance path approaching the FY 2025 target year and thereafter, as we seek 100% compliance. Current construction and planning documents indicate that an additional three facilities will be added to the HPSB inventory in FY 2016. ORNL has been notified of an award funded by the DOE Sustainability Performance Office (SPO) that will be applied to continued progress in the areas of HPSB beginning in December 2015 with work planned for completion in October 2017. With a "plan-do-check-act" strategy, emphasis will be placed on ensuring that the level of performance of buildings in the existing HPSB inventory is sustained. As it becomes increasingly more challenging to apply the GPs to more complex buildings, intensive effort and often capital investment are required to make significant changes toward reduction of energy consumption. Additional time will also be required to measure performance and verify savings. Efforts will continue toward expanding the existing HPSB inventory at a pace that does not compromise the ability to effectively manage the buildings that have already achieved HPSB status.

ORNL's Joint Institute for Biological Sciences, a HPSB

2.5 Regional and Local Planning

DOE Goal: Efforts to increase regional and local planning coordination and involvement.

Performance Status

Regional Outreach In 2013 ORNL and its regional partners announced a new nonprofit sustainability organization, the Southeast Sustainability Group (SSG). SSG comprises research, academic, and industry partners throughout the southeastern United States with a shared vision for advancing sustainability in the region—defined primarily as the EPA's Region IV (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, and Native American groups in the region). During FY 2015 SSG continued to review two project opportunities based on the four key areas of its charter (sustainable transportation, low-carbon power generation, energy efficiency, and water and waste management). These projects include the installation of solar capacity across the region to offset power being used by plug-in EVs and the adoption of highly efficient water heaters in residential and business applications. For additional information on SSG, go to www.southeastsustainabilitygroup.org.

Transportation Efforts ORNL and the leaders of the SCI Employee Transportation Roadmap actively engage in regional and local planning for sustainable transportation as well as outreach activities for the enhancement of sustainable transportation in the entire southeast region. In 2015 SCI coordinated with state and regional transportation programs to help create more effective, efficient, and affordable regional transportation and commuting options. Staff members from ORNL were active in participation in local and regional organizations, including service on the Board of Directors of the East Tennessee Clean Fuels Coalition, focusing on regional sustainable transportation options. These meetings are important in interactions with regional stakeholders, including Knoxville Area Transit (KAT), the City of Knoxville, and Smart Trips. ORNL remains committed in coordinating with local, state, and federal telecommute and rideshare initiatives.

Specific efforts include:

- participation in new UT, PSCC, ORNL bus route,
- participation in TN Workplace Charging Challenge,
- encouragement of Smart Trips participation by ORNL employees,
- collaboration with the local DOE Clean Cities coalition and regional stakeholders, including board service and active participation in quarterly meetings, and
- participation in the 2014 Southeast Alternative Fuels Conference.

Don't Miss the Bus!

Did you hear about ORNL's new bus service? You don't want to miss it! In an innovative partnership with UT and PSCC, a new bus route pilot program began during the fall semester, providing service between UT, PSCC, and ORNL. In addition to assisting ORNL staff interested in environmentally friendly bus service and commuter options, the route scheduling will help the large number of students engaged in research at the ORNL main campus and the ORNL Hardin Valley campus, which is located near PSCC. This new bus service is a successful and suitable option for commuting and a means to strengthen collaborations between all of three of the campuses.

Other Regional and Local Sustainability Planning Activities

ORNL is a leader in the region in promoting electric vehicle use and has been actively participating in regional workplace charging efforts, including the installation of 44 EVSE charging stations at the ORNL main campus and at the ORNL Hardin Valley campus. See Section 1.2, "GHG Reduction—Scope 3," for more information on ORNL charging stations.

A speaker from ORNL participated in the October 2014 Southeast Alternative Fuels Conference, held in Raleigh, North Carolina. The conference featured sessions on smart travel, including trends in the southeast regarding transit, telecommuting, and ridesharing as well as sessions on public-private partnerships.

Plans and Projected Performance

- Continue active participation in SSG.
- Further develop the regional transportation planning partnerships with Smart Trips and KAT.
- Report on the Southeast Alternative Fuels Conference, focusing on regional transportation planning.
- Continue to participate in the Knoxville Regional Transit Development Plan to promote and coordinate ORNL's commute/transit needs into the long-range transportation strategy for the region.

2.6a Net Zero Buildings, Existing Buildings

DOE Goal: Existing Buildings: Energy Net-Zero and Waste or Water Net-Zero.

Beginning in FY 2025 and thereafter, DOE will be required to ensure a percentage of existing buildings above 5,000 GSF are energy, waste, or water net zero buildings. As part of the June 2016 Strategic Sustainability Performance Plan, DOE will be required to identify the percentage of existing buildings, by number or by gross square footage, that will, by FY 2025, be: 1. net zero energy, and 2. net zero water or net zero waste.

ORNL will begin to assess its existing building portfolio and attempt to identify candidate buildings with the greatest net zero energy, waste, and/or water potential. Significant barriers to attainment will also be identified so that they may be discussed internally, in agency working groups, and other appropriate forums.

2.6b Net Zero Buildings, New Construction

DOE Goal: New Buildings: Energy Net-Zero and Waste or Water Net-Zero.

Beginning in FY 2020 and thereafter, all new construction of buildings greater than 5,000 GSF that enters the planning process shall be designed to achieve energy net zero and, where feasible, water or waste net zero by FY 2030. Any planned new construction beginning in FY 2020 that will achieve net-zero energy by FY 2030 will be discussed.

ORNL will begin to assess the future designs for planned new building construction and attempt to identify candidate buildings with the greatest net zero energy, waste, and/or water potential. Significant barriers to attainment will also be identified so that they may be discussed internally, in agency working groups and other appropriate forums.

LEED building design rendition

LEED building after completion

Success Story: ORNL Building 8930, Chesnut Ridge Maintenance Facility—LEED Gold Certification Received in October 2015

Project Statement

Located on the main campus of ORNL, the Chestnut Ridge Maintenance Shop (Building 8930) exemplifies high performance and a minimal use of materials with a goal of meeting the DOE HPSB GPs. The construction process emphasized efficiency by minimizing waste and using on-site materials when available. Passive design elements such as an energy-efficient building envelope, building orientation, aperture sizing, and a reflective roof work together to greatly reduce mechanical system loads. For LEED and net zero considerations, ORNL has dedicated 318 MWh of RECs for Building 8930 for FY 2015 and FY 2016.

Summary Results

The Chestnut Ridge Maintenance Shop supports the SNS Complex at ORNL. The facility is a $6.3 million, 22,305 ft^2 maintenance shop completed in October 2015. The first floor is purposed to provide fabrication, repair, and testing of devices necessary to the operation of the SNS facility. The second floor provides office space for the engineers and technicians who staff the first-floor machinery and testing areas.

Extensive existing underground utilities informed the location and orientation of the new building. Given those constraints, the massing was defined to maximize passive

solar lighting and daylighting. On-site gravel (about 20 tons) was recycled for use in grading the site. Native drought-resistant vegetation was planted to minimize water usage. Due to the sensitivity of the equipment in the adjacent science building, foundation design and construction methods were controlled by the need to eliminate ground vibrations during construction.

Every phase of construction focused on sustainable practice. At least 85% of construction waste was diverted from landfills, 31% of all materials were recycled, all interior materials were low in volatile organic compound content and contained no urea-formaldehyde, and up to 40% of all materials were locally sourced. User experience is defined by continuously day-lit spaces with passive lighting systems driving the design strategy.

The building is a two-story steel framed structure clad in insulated metal panels with glazed curtain wall and storefront window units. The benefit of continuous insulation with gasketed panel joints provided an energy-efficient and low-infiltration building envelope. The design limits interior finish materials to areas where necessary and utilizes envelope and structural material as interior finishes where appropriate. The Lab received official notification of LEED Gold Certification for Building 8930 in October 2015 and will be included in the HPSB inventory.

2.7 Data Center Efficiency

DOE Goal: Establish a PUE target of 1.2 – 1.4 for new data centers and less than 1.5 for existing data centers.

Performance Status

Currently, one data center is under design for a high performance computing (HPC) system. The data center will incorporate a waterside economizer, which will enable cooling without the use of a chiller for more than 60% of the year. It is expected that this design will result in a power utilization effectiveness (PUE) of better than 1.15.

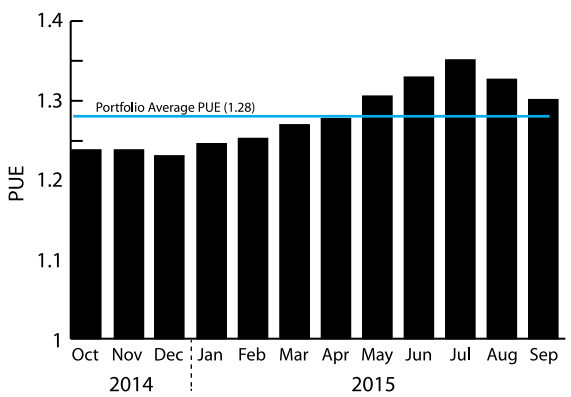
In FY 2015 ORNL's Computation Facilities Complex (CFC) experienced an average data center portfolio PUE of 1.28. The CFC strives to continually improve all facets of its operation. Below are examples of improvements and strategic industry engagement to facilitate continued infrastructure enhancements that will increase the efficiency of facility energy use.

- A new high-voltage entry point will provide substantial savings by reducing medium-voltage distribution losses. An estimated 2.5 miles of overhead, 13.8kV, transmission lines were bypassed for more efficient and reliable power distribution to HPC loads. This new infrastructure has provided energy savings and increased reliability since day one of its operation.
- Recognizing the value in highly reliable infrastructure, ORNL is entering its fifth-year partnership with the UT Reliability and Maintainability Center. Increased uptime translates to less wasted energy. HPC systems consume a lot of energy when in production. If a problem with facility infrastructure causes the HPC systems to stop production, then not only is the science mission delayed, but power usage remains relatively high. The CFC Reliability Program brings value by increasing equipment life and keeping the overall complex operating as efficiently as it can.
- Air supply temperature set points on strategic air handlers in the high-performance data center have been increased 9°F. This is a testament to the air flow management that has been established and maintained. Other opportunities exist and are being pursued aggressively throughout the data center.
- Industry best practices and lessons learned are captured and shared with involvement of the Energy Efficient High Performance Computing Working Group (https://eehpcwg.llnl.gov/). Hosted by Lawrence Livermore National Laboratory (LLNL), this working group includes members from other national laboratories and from industry, including HPC system integrators and others from facilities hosting HPC. Subgroups include: Infrastructure (liquid cooling, controls, total power use efficiency, and energy reuse effectiveness), Computing Systems (procurement considerations, HPC grid integration, system workload power measurement), and Conferences (industry engagement).

In-Row Coolers providing zoned cooling with up to 30% fan energy savings

- Staff training is complete for the DOE Data Center Energy Practitioner Generalist and Specialist level certification. Through this training staff learned of tools that are available that will assist with our continuous improvement goals in efficiency.
- A staff member acting as a provisional corresponding member to the ASHRAE Technical Committee 9.9 attended his first meeting at the ASHRAE Annual Conference in June. Engagement with this group serves two purposes: to stay attuned to the direction and aggregate knowledge of the industry and to provide a conduit to share lessons learned and expertise back into this industry for the betterment of all.
- A humidification study was performed in one of our data centers. The intent was to confirm that measures implemented previously were performing as expected. Controls were found to adequately prevent simultaneous dehumidification and humidification by air handlers within the same space
- Real-time totalized PUE calculation has been established. Plans to improve upon ORNL's PUE are outlined in the next section.

ORNL's CFC Data Centers have a portfolio average PUE of 1.28, against the goal of less than 1.5. The chart shows how the totalized PUE trended month to month during FY 2015.

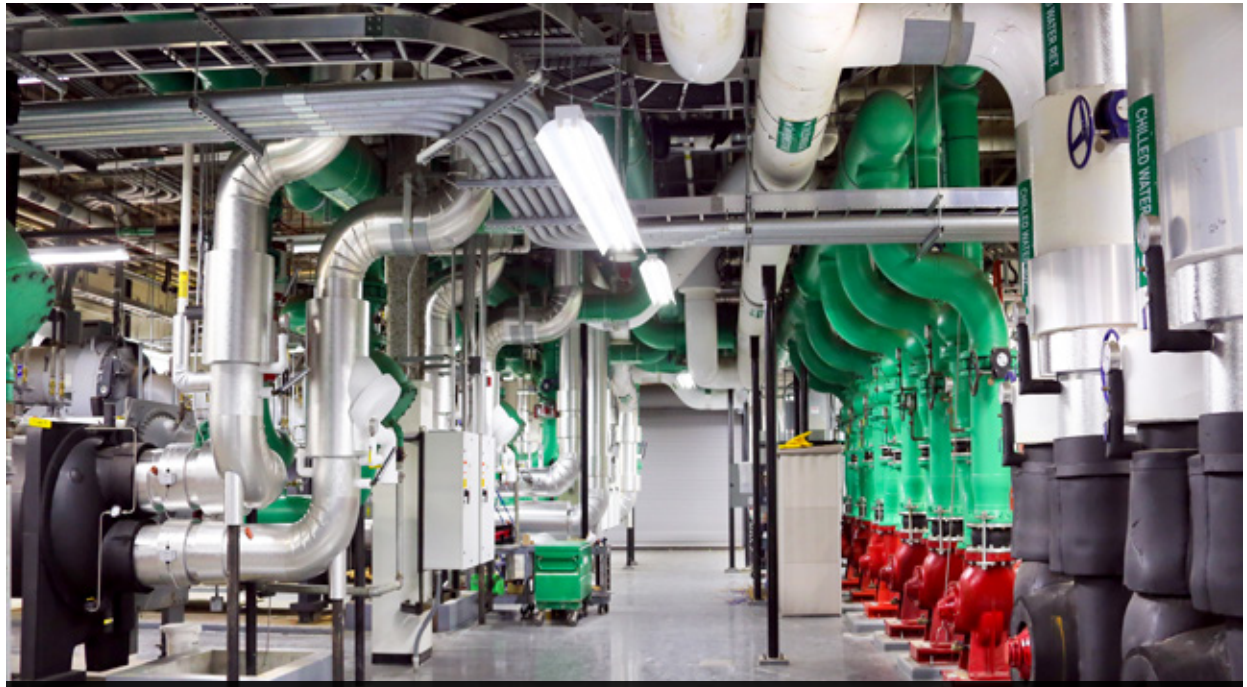


ORNL's Data Centers Monthly PUE for FY 2015

Plans and Projected Performance

Engineering staff have identified several areas in which to pursue additional energy savings. Challenges include maintaining the current level of redundancy, controls stability, and system resiliency. Below is a summary of areas and directives where ORNL CFC will seek energy savings in FY 2016.

- ORNL is engaging in the DOE Better Buildings Challenge: Data Center Accelerator program to realize a 25% improvement in PUE by the year 2020. PUE is a metric used to show the efficiency of a facility's data center support infrastructure. This is a testament to ORNL's goal of continuous improvement.
- Supply air set points are expected to be driven upward this coming year. One data center is currently within the ASHRAE recommended inlet temperature window, but we feel we can go further in specific areas.
- With the lowering of the lower limit for relative humidity in ASHRAE's recommended envelope for the inlet conditions to IT equipment, we plan to investigate the elimination of humidification in our data centers. This will save energy and water use in the data centers if our legacy equipment can accommodate the wider range in relative humidity.
- A feasibility study is part of an investigative effort that will provide insight into adding an economizer to one of our data centers that has a design that could easily be retrofitted.
- Optimizing the control of our chilled water plant is a primary area of focus, given that up to 50% of the total facility cooling power goes to the chillers. Areas of potential opportunity include:
  - operating chillers on head pressure control,
  - operating the chiller plant with a variable-speed driven chiller acting as a trim chiller and constant-speed chillers being base loaded, and
  - increasing the chilled-water supply temperature.



Chiller Plant with up to 6,600 tons of cooling capacity

- The humidification study will be expanded to the other data centers to verify compliance with the expectations of the controls systems and to determine whether any problems exist. Compliance requires not allowing simultaneous dehumidification and humidification as well as maintaining the dew point to the full extents allowed by the ASHRAE recommended inlet conditions. Rack densities are continuing to increase as expected. Options for waste heat reuse and possible economization integration will be explored for new systems in existing data centers.
- A specialized subteam is being formed to hold regularly scheduled meetings to discuss ongoing efforts to maintain and improve the CFC's metering, metrics, and reporting information about the data center that is important to management and engineering.
- Real-time PUE calculation will continue to be improved by adding additional metering devices to simplify the automation and to improve the accuracy.

GOAL 3: CLEAN AND RENEWABLE ENERGY

3.1 Clean Energy Goals for Total Electric and Thermal Energy

DOE Goal: Percentage of total electric and thermal energy from renewable and alternative sources shall be not less than: 10% in FY 2016-2017, working towards 25% by FY 2025.

Beginning in FY 2016, EO 13693 expands energy goals to include clean alternative energy sources in addition to the previous goals related to renewable electrical energy. Goals include thermal energy from renewable and alternative sources. Pursuing clean sources of energy will improve energy and water security while ensuring that federal facilities will continue to meet mission requirements and lead by example.

Alternative energy projects for the clean energy target include the following, in addition to the purchase of RECs when cost-effective:

- installing thermal renewable energy on site and retaining corresponding renewable attributes or obtaining equal-value replacement RECs where applicable,
- installing combined heat and power processes on site,
- installing fuel cell energy systems on site,
- utilizing energy from new SMR technologies, and
- utilizing energy from a new project that includes the active capture and storage of carbon dioxide emissions associated with energy generation.

The purchase of RECs for the Renewable Energy Target (Goal 3.2) can also be counted toward the new Clean Energy goal. ORNL REC purchases in FY 2015 resulted in achieving a benchmark of 8% of the Clean Energy Target as we prepare to meet the 10% interim target in FY 2016.

3.2 Renewable Electric Energy Goals

DOE Goal: Renewable electric energy sources shall be not less than 10% of total electric consumption in FY 2016-2017, working towards 30% by FY 2025. (FY 2015 Target: 7.5%).

ORNL plans and actions are moving toward achievement of the DOE Order 436.1 goal of providing 7.5% of the site's electrical consumption from renewable sources by FY 2015 and 25% by FY 2025 and beyond. Until recently, renewable energy (RE) was generated primarily by small research-oriented photovoltaic (PV) systems. A 5 kW PV array was brought on line in early FY 2008, and a 50 kW PV array began providing electricity in FY 2009. A 47 kW PV array for the EV parking canopy went on line in FY 2011 and may also be used to offset the power used for 25 EV charging stations. A smaller, rooftop PV array (30 kW) on Building 4100 also contributes to ORNL's on-site RE generation capabilities.

Performance Status

Currently, ORNL has identified multiple sources of RE to offset the site total electrical consumption of 591,759 MWh, including the following:

- 149 MWh of electricity produced on site by the four solar arrays account for approximately 0.05% of ORNL electricity, which includes the double bonus allowed for on-site generation at federal facilities. Associated RECs are retained for use by the site.
- ORNL participated in the TVA Southeastern REC pilot by purchasing 6,000 MWh of renewable energy in FY 2015.
- ORNL purchased 60,000 MWh of RECs from wind resources in 2015.
- ORNL consulted with REC brokers for the possibility of RECs available for purchase from Indian Lands. Brokers indicated difficulty in identification of available RECs on the Green-e Energy market. RECs from Indian Lands were also priced much higher than open-market RECs.
- At 11.2%, the total RE (production plus all RECs) of 66,149 MWh exceeds the FY 2015 goal of 7.5%.

As an additional benefit of meeting the RE goals, energy generated from approved renewable sources—either generated on-site or purchased from off-site vendors—may be allocated to new or significantly renovated buildings to assist in achieving LEED certifications for the rating desired. This approach will ensure that new buildings and major renovations maintain their dedicated renewable resource in case future funding is limited and would not permit a laboratorywide REC purchase. ORNL has dedicated RECs for two buildings undergoing the LEED certification process. Buildings 4500-N Wing 3 and the 8930 Chestnut Ridge Maintenance Shop have received sufficient RECs to cover all their electrical consumption for a "net zero" energy application for LEED.

Plans and Projected Performance

ORNL has undergone a preliminary feasibility study for an industrial-sized solar array (1 to 5 MW capacity) to take advantage of a current tax incentive for third-party

financing of renewable projects. Even with incentives it was determined that the implementation of a project of this sort would result in a significant premium when compared to ORNL's favorable wholesale electricity rates. Pumped storage and hybrid hydro/solar systems are other renewable projects in consideration for additional analysis.

Because of the high cost of on-site RE projects, the search for renewable production is challenging. The following strategies have been mapped to meet the annual progression toward the 25% goal by FY 2025.

- RECs—ORNL will periodically monitor the REC open market and will consider purchases as they are needed to meet the renewable goal.
  - Renewable energy resources (RECs and/or bundled energy) from Indian Lands will be included in the open market search for purchase consideration.
  - The purchase quantity of RECs will include the amount to meet or exceed both the Renewable Target and the Clean Energy Target when renewable thermal energy is not available.
  - As an extra benefit, REC purchases can also help to offset Scope 2 emissions and are counted toward Scope 2 GHG reduction goals.
  - ORNL will use multiple purchases throughout the year based on energy consumption projections and REC pricing to allow strategic purchasing of RECs to best fit the interim annual incremental targets to achieve the 25% goal for FY 2025.
  - RECs are likely to be considered in the short term until a cost-effective, feasible solution for on-site electrical generation can be developed and implemented. ORNL's primary strategy is to develop on-site capabilities before considering other options.
  - It is anticipated that the growing demand for RECs in general, and specifically the demand for REC projects that have been on line for less than 10 years, will drive an open market price increase for RECs.
  - ORNL will develop specific REC strategic purchasing guidance to help incorporate these strategies in a living document to help determine the best value for REC purchasing. Guidance will also include dedication of REC to specific buildings for LEED certification or other goals.

Bethel Valley Road photovoltaic array

- Renewable methane—ORNL has investigated the use of renewable methane as a means of meeting RE goals and has a strategy that can be implemented with limited capital investment. Working with its natural gas broker, ORNL can purchase renewable natural gas via pipeline delivery for use in reciprocating or turbine generators. ORNL has performed careful financial analyses and found this to be the best non-REC method for meeting its RE goals, with a premium cost for natural gas. The opportunities have been discussed with the ORNL Leadership Team.
- SMR—ORNL is supporting a strong regional commitment to clean energy, facilitated by the potential construction of an SMR that could be built with prospective financial support (possibly clean energy certificates) provided by DOE, the Oak Ridge Office (ORO), and/or ORNL.
  - In December 2012, DOE began a cost sharing agreement aimed at promoting SMR clean energy technology that will eventually lead to construction of an SMR on a site in Oak Ridge on TVA land adjacent to ORNL. In June 2015, DOE entered into an interagency agreement directly with TVA to continue the DOE investment to help obtain Nuclear Regulatory Commission licensing and achieve commercial operation within the mid-2020's. SMRs provide a low-carbon, high-reliability energy option. Although the project might reach production after the target year of FY 2025, it demonstrates an overall commitment to reducing GHG emissions into the future.

GOAL 4: WATER USE EFFICIENCY AND MANAGEMENT

4.1 Potable Water Use Intensity

DOE Goal: 36% potable water intensity (G/GSF) reduction by FY 2025 from a FY 2007 baseline. (FY 2015 target: 16%).

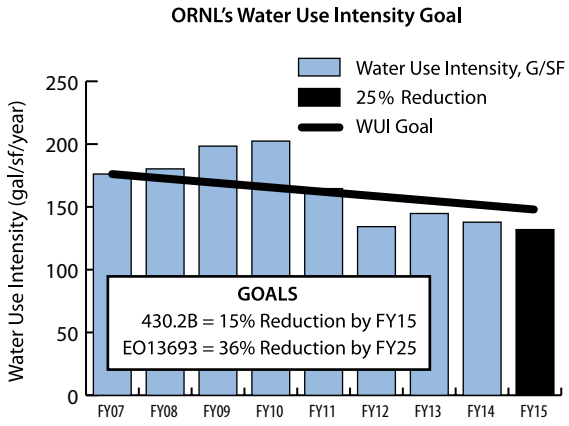
EO 13693 continues the federal commitments established by prior directives with a goal of 36% reduction in water use intensity (WUI) by the FY 2025 target year. DOE set a WUI reduction goal for potable water in FY 2007 relative to an FY 2007 baseline. ORNL has long been aware of the benefits of effective water management, and, by FY 2007, as a result of a variety of operational initiatives, ORNL had already experienced a 57% reduction in water use compared with its highest water use (experienced in FY 1985).

Performance Status

ORNL has developed an aggressive plan to reduce water consumption that includes repairing leaks, replacing old lines in the site water distribution system, and eliminating once-through cooling (OTC) where possible. The cumulative result of these efforts is a WUI of 132 gallons per gross square foot (G/GSF) in FY 2015, a reduction of 25% from FY 2007, which exceeds the incremental goal of a 16% reduction.

- Significant WUI improvement activities were initiated in FY 2008 upon the award of an ESPC, resulting in savings of 170 million gallons per year (MGY).
- The ORNL Utilities Division has worked with two different leak detection companies to identify and repair leaks in the water distribution system across the site. In addition, the Utilities Division has replaced identified sections of piping and has repaired leaks found in the process of replacing lines. An effort by FMD to identify and repair leaks within buildings has also resulted in significant water savings. In addition, the research and development organizations have installed stand-alone coolers or flow reducers where OTC could not be eliminated.
- The commissioning of Building 4100 moved historically inefficient operations from Buildings 3150, 4508, 4500N, and 4500S. Another heavy user, the Physics Division in Building 6000, has implemented a project to drastically reduce its use of OTC by installing flow control valves and by eliminating cooling water entirely when air-cooled fans can be used.
- ORNL continues to repair and replace a very old and leaky process water distribution system. This was a multi-year effort that required the installation of new backflow preventers in several buildings. Savings will continue to be realized as the main isolation valves to the system have been permanently closed.
- To better understand water use at ORNL, a water-metering plan is being implemented. As a part of this plan, assessments identified the 33 facilities that account for 90% of water use at ORNL. To date, 21 of these 33 facilities have been metered with advanced meters. The meters are connected to the ORNL CEDS and are collecting interval data. In addition, all of ORNL's cooling tower makeup water supplies are metered; most of the metering devices are advanced meters. An advanced meter was installed on one of the site's water distribution supply mains, establishing a foundation for additional distribution-side meters in the coming years.

Water saving results from identifying/replacing old water distribution system



ORNL performance status to FY 2015: WUI reduction of 25% is ahead of the DOE goal.

Plans and Projected Performance

With continued modernization activities that include both elimination of old facilities and the addition of new facilities, ORNL must consider more water-efficient systems in order to meet future WUI reduction goals.

A facility disposition plan has been developed through FY 2020. Facilities totaling 122,827 ft^2 that use nearly 1.5 MGY of potable water are planned for demolition by the end of FY 2020. This activity is funded by the DOE Office of Environmental Management.

A strategic plan has been developed through FY 2020 to add new facilities to meet mission goals. Facilities totaling 128,000 ft^2 that will use an estimated 8 MGY of potable water are planned for completion by the end of FY 2020.

- Planned growth to support ORNL's HPC mission is projected to result in additional water consumption for cooling towers. Water consumption for this additional capacity is expected to peak in FY 2018 at 280 MGY.
- Plans have been made to install advanced water meters in three additional large facilities, one additional cooling tower, and one additional distribution location during FY 2016. Several new locations on the site water distribution system will be evaluated for advanced metering.

Deep analysis of accumulated water meter interval data will be an increased focus area.

- Several water-saving initiatives are underway or planned through FY 2020 that are anticipated to save an additional 11 MGY of potable water.
- A project to eliminate OTC in Building 4508 and to replace it with a closed-loop chilled-water loop will be completed and will save an estimated 80 to 100 MGY. Currently this project is scheduled for FY 2017.

Current performance and future projections indicate that ORNL's WUI is subject to rise due to increased demands for cooling tower makeup water to support growth of HPC systems. Therefore, ORNL will need to be aggressive in pursuing additional water-savings opportunities to offset mission-specific demands in order to align with the FY 2025 goal established with EO 13693.

4.2 Industrial, Landscaping, and Agricultural Water Consumption

DOE Goal: 30% consumption reduction of industrial, landscaping, and agricultural (ILA) water by FY 2025 from a FY 2010.

Industrial, landscaping, and agricultural (ILA) water is defined by federal guidance as all nonpotable freshwater (surface and groundwater sources). Because all water at ORNL is potable water, all use at ORNL will be included in the potable water category, and no water will be included in the ILA category.

Performance Status

Not applicable.

GOAL 5: FLEET MANAGEMENT

5.1 Reductions in Fleet Petroleum Consumption

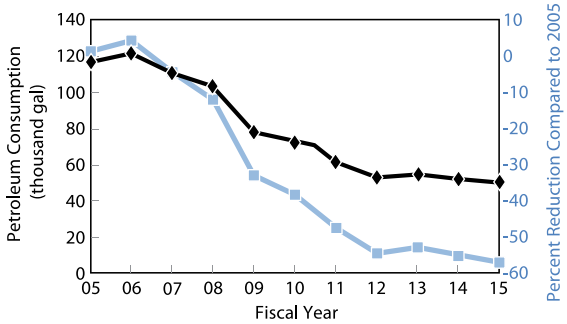
DOE Goal: 20% reduction in FY 2015 relative to a FY 2005 baseline; maintain 20% reduction thereafter. (FY 2105 target: 20%).

Note: Fleet vehicle data are available in the FAST system. Fuel calculations are in natural units of gallons, not gasoline gallon equivalents.

Performance Status

Fuel data for FY 2015 indicate that ORNL has exceeded the cumulative target of a 20% decrease in petroleum consumption by achieving a cumulative decrease of 57% compared to the 2005 baseline, as shown in the accompanying figure. Petroleum consumption in 2015 was reduced by more than 3% during FY 2014 through an ORNL Fleet Management strategy of focusing on alternative fuel vehicles (AFVs), highly fuel-efficient hybrid vehicles for passenger sedans, and promotion of practices such as an idle time reduction campaign and the use of bicycles on campus. ORNL has strategically placed 100 bicycles throughout the campus for staff use in order to help with sustainability goals, including the reduction of fleet vehicle use. Twenty-seven percent of the low-speed vehicles (LSVs) used on campus are EVs.

To ensure that the current level of progress is maintained, ORNL will continue to increase use of alternative fuels, increase the fuel economy of fleet vehicles, and reduce the number of vehicle miles driven.



Petroleum consumption and cumulative percentage decrease from FY 2005.

Plans and Projected Performance

As funding is provided, as appropriate approvals are granted, and as the mission dictates, ORNL will continue to replace inefficient vehicles with AFVs and hybrids, replace heavy-duty vehicles with units that have a smaller gross vehicle weight rating, and, when possible, replace gasoline LSVs with electric LSVs.

ORNL's planned fleet measures include the following:

- Zero waivers for using petroleum fuel in AFVs,
- Zero missed opportunities for fueling AFVs with alternative fuels,
- Replacement of older vehicles with AFVs and hybrids as funding allows,
- Continued emphasis of initiatives that will decrease idling practices by personnel,
- Procurement of hybrid vehicles to provide the on-site taxi/shuttle activity with fuel-efficient vehicles, and
- Continued reduction of vehicle miles traveled (e.g., through teleconferencing, trip consolidation, use of mass transportation).

The risk assumption associated with this goal is related to the availability of alternative fuels. ORNL currently has four types of fuel available on the site: unleaded gasoline, E85, biodiesel, and diesel. If E85 or biodiesel becomes unavailable, or if any technical problems with these fuels or fueling infrastructure arise, gasoline and diesel fuel will have to be used.

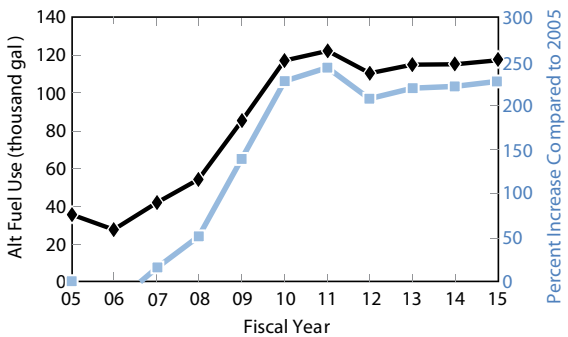
5.2 Fleet Alternative Fuel Consumption

DOE Goal: 10% increase in annual alternative fuel consumption by FY 2015 relative to a FY 2005 baseline; maintain 10% increase thereafter. (2015 target: 10%).

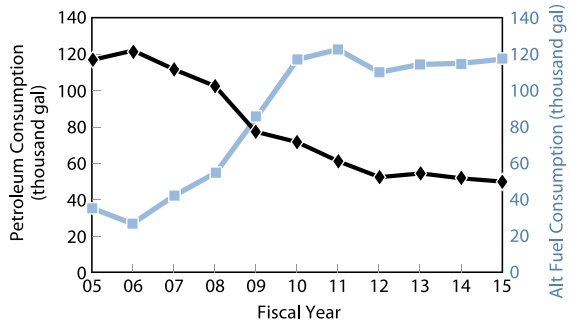
Note: Fleet vehicle data are available in the Federal Automotive Statistical Tool (FAST) system. Fuel calculations are in natural units of gallons, not gasoline gallon equivalents.

Performance Status

Fuel data for FY 2015 reflect that ORNL alternative fuel use has increased from the 2005 baseline by 227%, far exceeding the target. The graphs included in this section demonstrate ORNL's commutative progression in alternative fuel use both in percentage increases per year and in comparison of alternative fuels to traditional petroleum products. Petroleum use continues to decline as alternative fuels prove to be available and are used.



Alternative fuel consumption and cumulative percentage increase from FY 2005 to the present.



Comparison of petroleum vs alternative fuel consumption from FY 2005 to the present.

ORNL currently has three alternative fuel pumps on site and an on-site fueling truck that dispenses B20 (biodiesel) fuel to equipment and vehicles.

An outside fuel test laboratory frequently tests the E85 fuel at ORNL to determine the ethanol content. Any interruptions in the availability or quality of alternative fuels could quickly lead to reduced alternative fuel use and increased petroleum use, which would set back our progression toward SSP goals. Now that the vehicle purchases have been made for FY 2015, 61% of the fleet is made up of flexible fuel vehicles (FFVs). In addition, 83% of the vehicles, including recently purchased plug-in hybrid vehicles (PHEVs), can use alternative fuel.

ORNL continues to be a leader in the Southeast for alternative fuel fleet use and remains involved in alternative fuel outreach through partnerships with the local DOE Clean Cities program (East Tennessee Clean Fuels) and by providing experts at local public outreach and education events. Such events highlight ORNL's experience and expertise in alternative fuel use. ORNL's educational outreach efforts help the public make informed decisions regarding the benefits and challenges with alternative fuel use. In addition, ORNL was invited to give a presentation on the future of optimizing engines for alternative fuels at the 2014 Southeast Alternative Fuels Conference, which was held in October 2014 in Raleigh, North Carolina.

Plans and Projected Performance

ORNL's planned fleet measures include continuing to replace older vehicles with AFVs as funding will allow, continuing to focus on flexible fuel passenger vehicles, and obtaining approved B20-capable vehicles when possible. A total of 26 vehicles were purchased in FY 2015, consisting of light-duty, medium-duty, and heavy-duty vehicles and passenger vehicles. Twenty-one of these acquired vehicles were AFVs, and one was a plug-in hybrid sedan. There are now three plug-in hybrid sedans in ORNL's 439 vehicle fleet, and 83% of fleet vehicles are AFVs. ORNL is also continuing to procure electric LSVs as funds allow and when missions can use such equipment. If funding is maintained and vehicle appropriations are granted, ORNL anticipates purchasing 12 to 14 new AFVs each year.

To continue ORNL's progress toward the goal of zero missed opportunities for fueling AFVs with alternative fuels, AFV fuel use will continue to be assessed on a monthly basis.

Funds and availability of fuels continue to challenge the fleet program. Issues with reported concerns of biodiesel quality during the winter months resulted in a reduction of B20 use for FY 2015.

Budget reductions will hinder the purchase of electric and hybrid replacement vehicles. To purchase these vehicles, ORNL must be granted approval by congressional appropriation to DOE Headquarters. Inconsistency of agency appropriations impedes the replacement vehicle planning process.

5.3 Reductions in Greenhouse Gas Emissions

DOE Goal: 30% reduction in fleet-wide per-mile greenhouse gas emissions by FY 2025 from an FY 2014 baseline. (FY 2015 target: NA; FY 2017 target: 4%).

Note: Fleet vehicle data are available in the FAST system.

Performance Status

GHG emissions calculations will be evaluated by ORNL after validated data are provided by the Federal Energy Managment Program (FEMP) via the FAST system.

Plans and Projected Performance

ORNL plans to support the GHG emission initiative through purchasing PHEVs,

5.4 Light Duty Vehicle Purchases Must Be Alternative Fuel Vehicles

DOE Goal: 75% of light-duty vehicle acquisitions must consist of alternative fuel vehicles (AFVs) (2015 target: 75%).

Note: Fleet vehicle data are available in the FAST system.

Performance Status

ORNL continues to support the AFV acquisition requirement by purchasing available FFVs from the General Services Administration (GSA). Additional purchases will continue to depend upon available funding and approval. In FY 2015 22 light-duty vehicles were purchased, representing 100% of vehicles that could be purchased with alternative fuel capability.

Plans and Projected Performance

ORNL will continue to replace vehicles that meet the 41 CFR 102-34.270 criteria with AFVs as funding and appropriations allow.

Costs continue to be higher for hybrid vehicles and/or EVs than for E85- or B20-compatible vehicles. Until initial costs of EVs are comparable with those of other vehicles, the decision to purchase EVs will continue to be a challenge. In addition, EV selection on the GSA vehicle-ordering system is limited compared to the selection of FFVs and B20-compatible vehicles.

ORNL has two on-site E85 fuel pumps, one on-site B20 pump, and the fuel truck that also hauls B20 to fuel vehicles and equipment that cannot use the fueling station. To continue to successfully use B20 in compatible vehicles, ORNL will continue to monitor the quality of the B20 fuel.

ORNL has a total of 439 agency-owned vehicles. A total of 26 vehicles were purchased in FY 2015, consisting of light-duty, medium-duty, and heavy-duty vehicles and passenger vehicles. Twenty-one of the acquired vehicles were AFVs, and one was a plug-in hybrid sedan. There are now three plug-in hybrid sedans in ORNL's 439-vehicle fleet, and 83% of fleet vehicles are AFVs. If funding is maintained and vehicle appropriations are granted, ORNL anticipates purchasing 12 to 14 new AFVs each year.

5.5 Zero-Emission or Plug-in-Hybrid Electric Vehicles

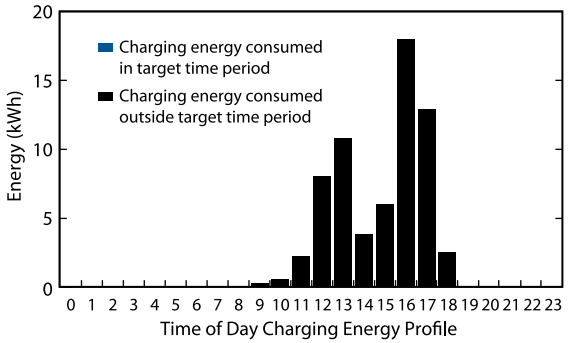
DOE Goal: 20% of passenger vehicle acquisitions must consist of zero emission or plug-in hybrid electric vehicles by FY 2020, working towards a goal of 50% by FY 2025.

Note: Fleet vehicle data are available in the FAST system.

Performance Status, Plans, and Projected Performance

ORNL began purchasing PHEVs in FY 2013. It now has a total of three PHEVs in the fleet. As funding becomes available and as appropriations are made for purchasing passenger-carrying vehicles, ORNL will continue to acquire these types of vehicles.

ORNL has installed and will continue to install on-site EV charging infrastructure to support the goal of acquiring PHEVs. ORNL has installed a Fleet Carma telematics device on one PHEV (a Ford CMAX Energi) to collect data on use, battery charging, and fuel economy of the vehicle. The device records data for each trip and cumulative data for distance; energy use by type (gasoline engine + electricity); and driver behavior, including hard accelerations, the number of idle events, and the amount of fuel consumed during idling. In addition to driving details and driver behavior details, charging details including type of charger and summary of time of day are recorded, as shown in the figure. The data will be used in making decisions of where to best utilize PHEV and charging infrastructure as more PHEVs are added to the ORNL fleet.



Example telematics data on distribution of charging data for June 2015.

GOAL 6: SUSTAINABLE ACQUISITION

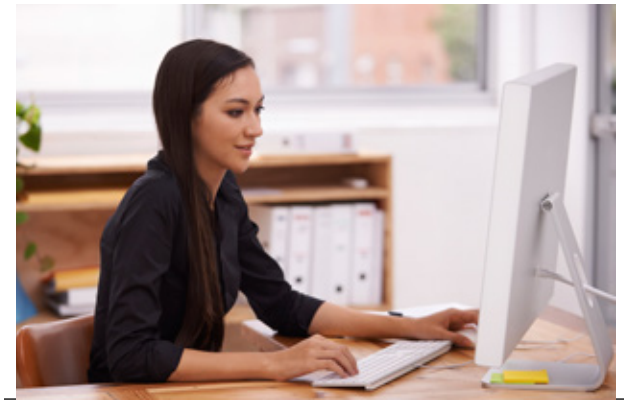
6.1 Sustainable Acquisition and Procurement

DOE Goal: Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring BioPreferred and biobased provisions and clauses are included in 95% of applicable contracts.

Performance Status

ORNL has made significant progress in its efforts to ensure that 95% of all new contracts, including nonexempt contract modifications, require products and services that are energy-efficient, water-efficient, biobased, environmentally preferable, non-ozone-depleting, and nontoxic or less-toxic alternatives, and that contain recycled content.

- Standard contract terms and conditions, which are made part of all procurement actions for commercial items and services, invoke the pertinent Federal Acquisition Regulation (FAR) contractual requirements for energy efficiency, and sustainability. Those clauses were included in 100% of the following FY 2015 subcontract actions:



  - All of the 22,796 unique subcontracts, purchase orders, and task orders and 66,254 purchases issued against blanket ordering agreements meet the DOE procurement requirements.
  - Terms and conditions issued with blanket ordering agreements not only contain all FAR provisions, but also include additional requirements for promoting and providing environmentally preferable products.
  - The Contracts Division includes subcontract language with key commodity suppliers requiring that they provide detailed reports on the purchases of electronics products designated ENERGY STAR and Electronic Product Environmental Assessment Tool (EPEAT).
  - Simplified procurements of minor purchases made using an authorized purchasing card (P-Card) are exempt from provisions related to sustainable acquisition. During FY 2015 there were 24,998 P-Card transactions.
  - To reduce the use and expenses of paper and printer toner, ORNL's Contracts Division established an electronic file initiative, converting all active hard-copy subcontracts to an electronic database. All new subcontracts awarded after October 1, 2012, are maintained electronically.

Plans and Projected Performance

The Contracts Division is working toward the establishment of a Lab-wide paperless initiative for all P-Card transactions to complement savings in paper and toner expenses, and storage requirements.

As standard practice to ensure continued compliance with the DOE goals, including updates from EO 13693, ORNL Procurement will include clauses and provisions that stipulate environmentally preferable purchasing requirements in all applicable purchase orders, subcontracts, and task order actions issued in the future. All material releases against blanket ordering agreements will continue to be governed by the provisions included in the standard terms and conditions, also ensuring compliance with goals.

As indicated in EO 13693, three FAR clauses will be added to the standard Commercial Items Terms and Conditions contracts beginning in January, 2016:

- FAR 52.223-2 Affirmative Procurement of Biobased Products Under Service and Construction Contracts (September 2013)
- FAR 52.223-13 Acquisition of EPEAT ® - Registered Imaging Equipment (June 2014)
- FAR 52.223-14 Acquisition of EPEAT ® - Registered Televisions (June 2014).

GOAL 7: POLLUTION PREVENTION AND WASTE REDUCTION

ORNL's pollution prevention (P2) plan embodies the commitment of ORNL management and staff to reduce waste generation and toxicity; to promote sustainable acquisition and resource conservation; to embrace sustainability, stewardship philosophies, and sustainability measures; and to fully comply with state, federal, and DOE requirements concerning P2.

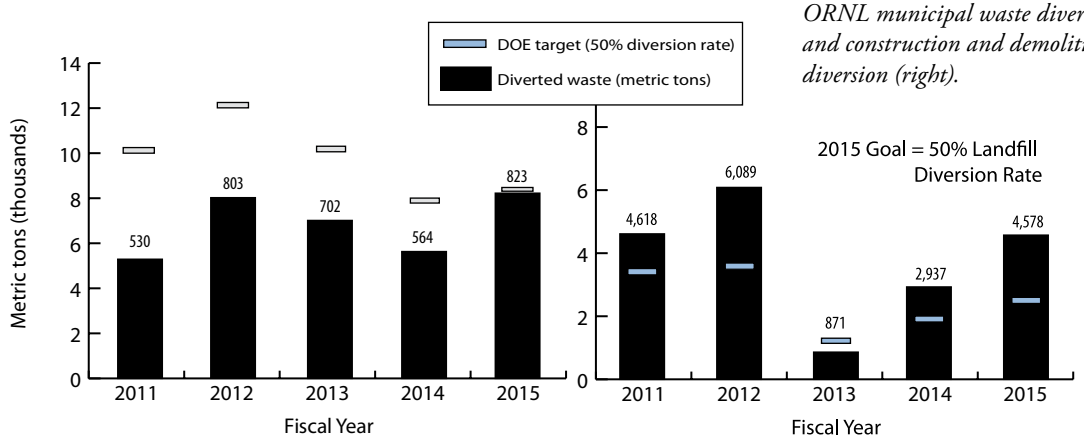
The regulatory-required P2 program and plan document the elements of the program, capture ongoing and planned activities, and are wholly supportive of DOE's sustainability program initiatives. Accomplishment of the ORNL goals, outlined as follows, requires the merger of administrative and cultural changes with new technologies and procedures.

- The generation of waste and pollutants is minimized through source reduction. ORNL has long focused on source reduction as the primary way of reducing waste generation, including sanitary, hazardous, and radioactive waste.
- The philosophy is incorporated in our work controls for research and operational activities:
  - Practices to keep exposures as low as reasonably achievable,
  - chemical hygiene,
  - work control procedures, and
  - National Environmental Policy Act (NEPA) project reviews.
- Each year, waste-generating divisions select one or two projects to implement that will address ORNL's identified objectives and targets under the Laboratory's Environmental Management System. The divisions select

a waste reduction, energy efficiency, or procurement project to implement during the course of the year. The projects are shared with other appropriate divisions and, in many cases, other DOE sites and DOE Headquarters as P2 success stories.

- The P2 focus has been to reduce the amount of material going to the landfill.
  - Development of contract language requiring construction contractors to recycle as much construction debris as possible and to report the recycled amounts has resulted in significant amounts of material being diverted from the landfill.
  - For routinely generated waste, it was determined that as least 30% of the material in the trash could have been recycled in established programs. To improve compliance with goals, recycling containers have been distributed to offices and breakrooms. Large recycling bins are provided in many areas, preventing common recycle materials from inadvertently being placed in the trash.
  - Assessments of specific operations and their pollution prevention practices were performed, including one at the National Transportation Research Center (NTRC).
  - Recycle/reuse is maximized for both municipal solid waste and construction and demolition waste, including off-site recycling of scrap metal and broken furniture.

The quantities of landfilled waste and diverted waste are highly dependent on the types of projects funded and can fluctuate. ORNL has, however, emphasized source reduction efforts such as the use of paperless systems as its preferred pollution prevention technique. As shown in the following bar charts, these source reduction efforts along with other factors, such as diversion, have contributed to the overall downward trend observed in the combined amount of municipal solid waste (MSW) and construction and demolition (C&D) waste sent to on-site landfills by the Lab. Based on its efforts to divert MSW and C&D waste, ORNL realized a 49% diversion rate for MSW and a 88% diversion rate for C&D waste in FY 2015.



ORNL municipal waste diversion (left) and construction and demolition waste diversion (right).

7.1 Reductions of Nonhazardous Solid Waste, Other than C&D Waste

DOE Goal: Divert at least 50% of nonhazardous solid waste, excluding construction and demolition debris.

Note: All MSW generated by ORNL is sent to an industrial landfill located on DOE ORO property. To eliminate double counting of greenhouse gas (GHG) emissions, ORNL MSW data are entered as "0" in the Consolidated Energy Data Report (CEDR) because the environmental management prime contractor counts all MSW for the entire ORO landfill as Scope 1. ORNL is responsible for the reduction of MSW, and the reporting in this section tracks progress toward meeting DOE waste generation reduction goals.

Performance Status

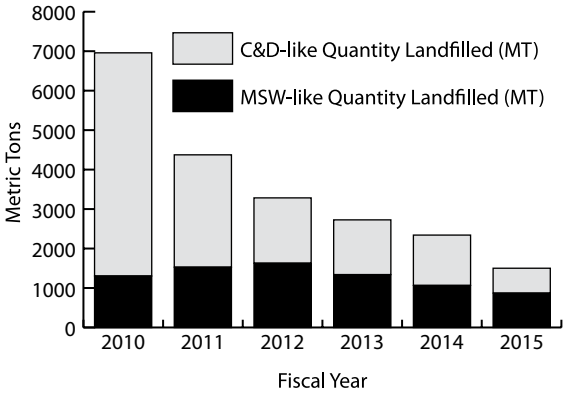
ORNL's diversion rate for MSW in FY 2015 reached 49% as supported by data reported in CEDR. Through a series of coordinated efforts we were able to achieve a significant increase compared to the prior 3 years, in which the MSW diversion rate averaged 34%.

ORNL has continued its initiatives and best management practices to reduce the amount of material going to the landfill, including the following.

- Materials going into trash cans and dumpsters are monitored to determine whether there are additional materials that have the potential for source reduction, recycling, or resale.
- Special recycling initiatives are supported and promoted to maximize recycling and duplication of these efforts. For instance, in FY 2015, the ORNL Research Library worked to reduce the number of older paper journals it houses in favor of providing perpetual digital access, transitioning 535 linear ft of paper journals and 281 microfilm cartridges to electronic format and recycling approximately 16,000 lbs of paper. A similar effort involved removing and recycling books and papers from a conference room's bookshelf-lined walls in Building 6000. Similar efforts will continue in FY 2016, such as the removal and recycling of books from the Building 6000 library.
- ORNL examined several MSW-generating operations to identify additional diversion efforts that could increase ORNL's diversion. In some cases, source reduction efforts were identified that would reduce generation such as transitioning to electronic documents and eliminating paper files before a group moves from one building to another allowing future source reduction due to electronic files

ORNL librarian and UT intern recycle paper journals from the research library

and recycling of old paper files. Additionally, boxes and packaging materials from ORNL Receiving are transferred to ORNL Shipping for reuse. This effort not only diverts material from being MSW but also reduces the costs for shipping materials for the Lab. Moreover, drums and specialty laboratory metals are both now being collected for recycle rather than disposal. In FY 2015, the recycle of pallets was identified as an opportunity to be pursued.



ORNL source reduction results

- Findings of missed recycling opportunities are presented to personnel to reinforce the mission of P2. A number of targeted meetings were offered in FY 2015. ORNL also provided information to DOE Headquarters and another national laboratory concerning systems available to exchange materials with other federal government sites.
- Communications with divisions and facility managers concerning which materials are acceptable in the recycling streams (e.g., fiberboard, colored paper) have continued to be enhanced, and efforts have been made to help them find additional outlets for saleable and recyclable materials.
- A hand dryer assessment report based on industry standards and customized to ORNL conditions was developed in FY 2015. The installation of hand dryers is a proven waste reduction practice, compared to the exclusive use of paper towels, but installation expenses can be cost-prohibitive in some buildings. FMD will review and study the risk of labor expense overruns as a next step in pursuing this sustainable practice.
- A video was created using ORNL staff to provide additional details for ORNL's onsite recycling Best Practices.

Plans and Projected Performance

ORNL will continue its initiatives and best management practices to reduce the amount of material going to the landfill, and we recognize the nonattainment for this goal with a current performance of 49% diversion rate. The following actions will continue to be implemented as a means to improve the diversion rate.

- Monitoring of materials placed into trash cans and dumpsters.
- Presenting findings of missed recycling opportunities to personnel to reinforce the mission of P2.
- Enhancing communications with divisions and facility managers concerning which materials are acceptable in the recycling streams.
- Reevaluating opportunities for composting by the ORNL cafeteria operator.
- Evaluating and implementing recycling of any new material streams identified.

7.2 Construction and Demolition Materials and Debris

DOE Goal: Divert at least 50% of construction and demolition materials and debris.

Performance Status

ORNL's diversion rate for C&D materials and debris has consistently exceeded the 50% goal, with the exception of FY 2013.

Diversion of construction and demolition materials and debris at ORNL

Fiscal year	2010	2011	2012	2013	2014	2015
Diversion rate (%)	86	62	79	39	70	88

In recognition of cost-savings opportunities, certain wastes were disposed as C&D debris rather than low-level radioactive waste as a result of efforts to extensively characterize wastes from demolition activities that would have otherwise been sent off the site for costly disposal as low-level radioactive waste. This effort allowed ORNL to determine that those wastes could be sent to the on-site landfills, which reduced waste management costs but also prevented the Laboratory diversion rate from being higher. Additionally, demolition waste generated in FY 2015 contained materials that prevented recycle. For example, metal and glass from old windows that had exterior glazing containing asbestos could not be recycled and were disposed of in the landfill as asbestos waste.

In FY 2015 materials from several ORNL activities were reused and recycled, including 40,000 lbs of concrete and 130,000 lbs of soil from a project at NTRC, 1,408 cubic yards of asphalt from the FY 2015 paving project, and 783 cubic yards of soil as clean cover at the on-site landfills.

Plans and Projected Performance

ORNL will continue efforts to divert C&D wastes such as the following:

- Effective contract language has been developed that requires construction contractors to recycle as much C&D debris as possible and to report the recycled amounts. That language will continue to be included in contracted construction projects.
- Building on the successful C&D recycling for construction contracts, ORNL expanded a C&D collection program started in FY 2011 for remodeling debris from activities in existing facilities. A new location has been identified for storing recyclable wallboard, rubble, wood, ceiling tiles, and metal, and a vendor has been contracted to conduct the recycling activities. The collection of remodeling debris will continue and will be expanded across the facility.
- Internal NEPA reviews are conducted for most projects performed at ORNL. The reviews promote discussion with project engineers to plan for the reuse of soils, concrete, asphalt, and other C&D materials. The P2 program team will continue to provide input on these reviews.
- Project managers and engineers include recycling opportunities in the project planning process, ensuring cost-effective diversion results.

Additional Qualitative Components within Goal 7

In addition to the quantitative components discussed in Sections 7.1 and 7.2, Goal 7 includes qualitative components that address a variety of areas, including the anticipated impact of population change; continuing construction, decontamination, and decommissioning activities; and changing laboratory research initiatives and priorities. These variables will continue to have a strong impact on recycling and waste generation rates and volumes. These and other elements, such as the following, will continue to be addressed.

- Waste generation is intimately associated with the number of people on the site and funding levels. Waste generation can also fluctuate with changes in research and development missions. For example, ORNL saw record amounts of waste generation associated with building demolitions funded by the American Recovery and Reinvestment Act.
- ORNL continues to experience an increase in retirees due to incentive programs, resulting in the one-time generation of waste from office cleanouts by the retirees. The Lab strives to maximize the recycling of old files and papers during these cleanouts.
- To address ever-changing needs, ORNL has focused on putting systems in place to promote sustainability. The integration of sustainable operations is addressed in the ORNL Laboratory Agenda, budget planning guidance, internal procedures, and procurement evaluations. ORNL will continue to look for focused opportunities for waste stream reductions but will also concentrate on the more sustainable practice of source elimination.
- ORNL does not currently have a waste-to-energy system and does not plan to pursue that type of system based on the type of waste that is generated at the Lab.
- ORNL is increasing the use of acceptable nontoxic or less-toxic alternative chemicals and processes while minimizing the acquisition of hazardous chemicals and materials. An operational assessment of chemicals reviewed the acquisition, distribution, storage, use, and reallocation and disposition of chemicals. The Chemical and Materials Sciences Building was designed to facilitate optimal chemical inventory management, chemical use, and sharing. The Chemical Management Center promotes the transfer of excess materials to new users, and the procurement pathway is designed to promote internal acquisition/exchange before purchase. For instance, during FY 2015, new unit substations were installed for one of ORNL's buildings and included transformers filled with biodegradable vegetable oil.
- ORNL implemented an integrated pest management program that includes both interior and exterior strategies for the entire Oak Ridge Reservation. Practices include environmental controls such as ensuring that all cracks and holes are sealed to minimize pathways for pests to enter a building and educating building occupants as to the importance of good housekeeping regarding food storage, waste collection, and plant maintenance. The goal is to reduce the exposure of building occupants and maintenance personnel to potentially hazardous chemical, biological, and particulate contaminants that adversely affect air quality, human health, building finishes, building systems, and the environment while controlling potential infestations of insects, rodents, fungi, and invasive plant species.
- ORNL continues to demonstrate its commitment to programs that enhance the physical environment through its landscape management practices, which include:
  - planning based on sustainable principles in the *Sustainable Landscapes Initiative 2020*,
  - identification of ecologically important areas in the ORNL vicinity per the *2010 ORNL Campus Master Plan*, a roadmap for the next 20 years,
  - working with potential mitigation area planning, and
  - promote increased buffers along riparian zones using native plantings, while actively controlling invasive non-native plants in these zones. Two major areas of focus to date have been First Creek and White Oak Creek. ORNL continues to develop native landscape plans to further enhance riparian zones throughout the campus.

- ORNL P2 staff participated in a team review of site property management procedures in FY 2013. As a result, ORNL has increased staff awareness of what materials can be sold and has expedited the process of reducing the amount of materials subject to both recycling and waste disposition. In FY 2014, a comprehensive review of site property management and sales was initiated. Due to these efforts, the property management and sales were updated and in FY 2015 became more efficient. Some of the efficiencies included having prequalified bidders bid periodically on tractor-trailer loads of excessed materials for public sale, moving material more quickly and efficiently, selling items in place and requiring the winning bidder to pick up the item, and increasing the amount of broken furniture sent off for recycle. In addition to avoiding costs and saving manpower, these efforts can reduce fuel use and the generation of GHGs. For instance, ORNL vehicles are no longer picking up items to take them to the warehouse when the items are sold in place.
- The ORNL P2 program continues to prioritize minimization of the generation of waste and pollutants through source reduction. Avoiding waste generation will be given precedence over recycling or reuse even if it appears to be a detriment to recycling/diversion goals. Several efforts were pursued in FY 2015. ORNL's Sustainable Campus Initiative partnered with the cafeteria contractor to reduce paper waste by offering refillable mugs with economical purchase and refill pricing. Increased double-sided printing at centralized network printers continues to reduce the amount of paper being used and subsequently recycled. Additionally, three years ago ORNL eliminated the purchase of bottled water except for instances in which staff members do not have access to plumbed water and installed drinking-water refill stations where appropriate. The avoidance of generating plastic bottles is the preferred outcome from both a waste and a cost perspective.

GOAL 8: ENERGY PERFORMANCE CONTRACTS

8.1 Energy Performance Contracts

ORNL will work with DOE, the SPO, and the SC Program Office as needed to assist in the development of agency-wide plans to meet the new FY 2017 targets for Energy Performance Contracts as directed in EO 13693.

At ORNL, the ESPC with JCI was the primary mechanism for achieving the goals established to meet EPACT directives. A delivery order with JCI was awarded in July 2008 and accepted in July 2012. The ECMs implemented by the ESPC included steam system decentralization, lighting upgrades, water conservation, building automation system modernization, mechanical equipment upgrades, and steam production improvements. This ESPC is creating opportunities for ORNL to improve its depth of experience in performance contracting and develop an understanding of the most effective utilization of this funding mechanism.

The sale of used furniture is an example of waste diversion efforts

The original Biomass Gasification Steam System experienced operational difficulties in September 2013. JCI replaced that system with a dual-fuel natural gas/fuel oil boiler, commissioned in September 2015. ORNL also installed two similar boilers to further enhance the steam system efficiency by replacing two existing, less-efficient vintage boilers. Other ESPC improvements include the building management system ECM by which modernized HVAC control systems were installed. These improvements provided the means to significantly reduce or eliminate energy-intensive simultaneous heating and cooling in several large air-handling units.

The perceived complexity of savings calculations and measurement and verification methods is a challenge to the use of performance contracting vehicles. This challenge may be addressed with expanded training and awareness instruction developed for site and agency personnel who are involved with project implementation and performance.

ORNL steam plant at night

GOAL 9: ELECTRONIC STEWARDSHIP

9.1 Electronic Stewardship—Purchases

DOE Goal: Purchases—95% of eligible acquisitions each year are EPEAT-registered products.

Performance Status

In FY 2015 ORNL met the requirements for electronics purchases with respect to EPEAT, ENERGY STAR, and FEMP. ORNL deployed a guided procurement system to route staff to the standard electronic device ordering system.

ORNL has a Managed Hardware Program (MHP) that provides a listing of approved standard hardware (i.e., desktops, laptops, and tablets) that may be purchased without further staff approvals. All electronic devices meet EPEAT, ENERGY STAR, and FEMP requirements. When necessary, nonstandard hardware may be requested by staff. Established automated procurement governance ensures that each nonstandard request is reviewed to see if the device complies with cyber security, configuration management, EPEAT, ENERGY STAR, and FEMP requirements.

ORNL continues to exceed 95% compliance with EPEAT standards for purchases of computers, monitors, laptops, and tablets. All desktop and laptop computers and monitors are ENERGY STAR qualified. ORNL installed a group of workstations for computer-aided design in FY 2015 to meet a specific design requirement. Currently those systems are ENERGY STAR certified but are not registered with EPEAT.

Plans and Projected Performance

ORNL's Green IT sustainable campus roadmap for FY 2016 includes the following:

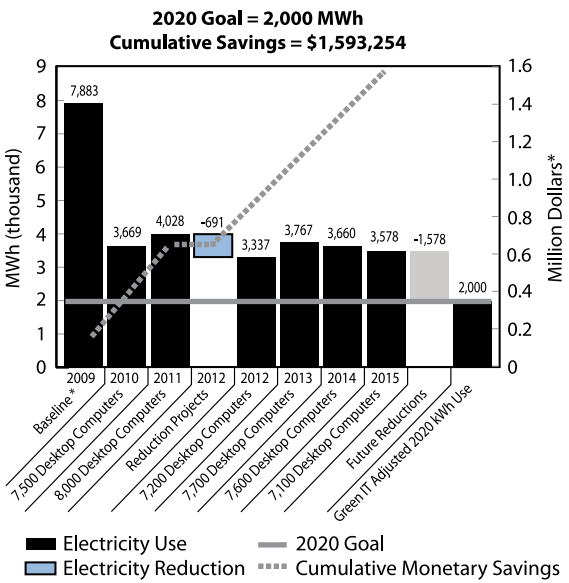
- ORNL will focus on minimizing the number of print devices that are purchased and will guide staff toward a standard set of shared network printers.
- ORNL will continue to closely monitor requests for nonstandard (i.e., non-EPEAT) computers, monitors, and laptops.

9.2 Electronic Stewardship—Power Management

DOE Goal: Power Management—100% of eligible desktops, laptops, and monitors have power management enabled.

Performance Status

As shown in the figure, ORNL has successfully met the electronic stewardship goal of power-managing 100% of the eligible personal computers, laptop computers, and monitors in use by Laboratory staff since 2009. The FY 2015 planned power management system upgrade was postponed to FY 2016 due to restrictions with staff resources. In addition, ORNL desktop virtualization efforts have reduced the number of physical devices being power-managed. The progression of power management electricity savings is shown in figure.



ORNL electricity and cost savings from power management.

The following Green IT policies and procedures are still in active use at ORNL.

- ORNL IT offers standard computer hardware through three vendors on the ORNL online purchasing system. The vendors are required to sell only EPEAT-certified computers, monitors, and laptops. Senior management must approve exceptions.
- All ORNL Windows computers, including servers, desktops and laptops, are required to have a secure screen saver (password required) with a timeout setting between 1 to 15 minutes. Windows screen saver configuration settings are enforced by the System Center Configuration Manager, which is managed by Information Technology Services Division (ITSD).
- All ORNL Macintosh systems (except those with an exception) are required to have a password-protected screen saver with an inactivity timeout between 1 and 20 minutes The graphical user interface only allows users to select 10-minute intervals. Settings are checked and changed, if necessary, every 12 hours by CFEngine, a configuration managment tool.
- Linux screen saver settings vary based on the operating system version and the desktop environment. Because of the large number of configurations and the lack of centrally configurable policies for some desktop environments, screen savers on the Linux platform are managed on a best-effort basis.
- All Windows desktops are required to be power-managed. The ORNL power management tool collects power use data on all laptops but is not used for managing power. The user performs laptop power management within the operating system. Devices registered as instruments or servers are excluded from power management. There is an exception process in place for users to exempt a system from power management when needed to meet mission goals.

Plans and Projected Performance

ORNL plans to upgrade the Laboratory device power-management software to provide security enhancements and to improve reporting. ORNL's Green IT sustainable campus roadmap for FY 2016 includes continued operation of the computer power management and monitoring system and an upgrade of the ORNL power management software to support Macintosh power management and improved laptop provisioning. After the power management system upgrade, ORNL will be able to power-manage the Windows 8 and Windows 10 devices.

9.3 Electronic Stewardship – Automatic Duplexing

DOE Goal: Automatic Duplexing–100% of eligible computers and imaging equipment have automatic duplexing enabled.

Performance Status

ORNL has successfully implemented a shared print services program to update existing multifunction print devices (print/scan/copy/fax) and to provide for other shared print devices. All new print services include automatic duplexing set as a default. An individual can override duplexing for a print job that requires single-side printing. In addition, locked print is an option for all new shared printers so users can release an individual print job by entering a personal identification number (PIN) at the printer as needed to limit others' access to a print job prior to retrieving the printout from the shared printer. Existing printers without duplexing capability are being replaced with print services that require duplexing capability.

The shared network printer services model is helping to standardize equipment, reduce energy consumption, reduce landfill waste, reduce the cost of operations, improve printing services in general, and provide more efficient use of consumable products. Over time, ORNL plans to shrink the printer equipment footprint and to save essential overhead costs by reducing toner purchases, support costs, and power demands.

ORNL plans to update print management documents and strategy with respect to the DOE Sustainable Print Management Guide once the guide is finalized.

Plans and Projected Performance

ORNL's Electronic Stewardship automatic duplexing FY 2016 planned efforts include the following:

- ORNL will continue to use implement shared network print devices with automatic duplexing set as a default.
- ORNL will continue to reduce the number of local print devices by providing additional shared network printers.

9.4 Electronic Stewardship—End of Life

DOE Goal: End of Life—100% of used electronics are reused or recycled using environmentally sound disposition options each year.

Performance Status

In FY 2015 ORNL met this goal with 100% of used electronics being reused or recycled using environmentally sound disposition options. These options include transfer to other DOE contractors, nonprofits, and schools, such as through the Computers-For-Learning (CFL) Program. Electronics that have reached end of life are recycled through a Responsible Recycling (R2) practices certified recycler.

ORNL has supported transfer of specific electronic components to other DOE contractors, nonprofits, and the CFL Program for decades. Since May 2012, ORNL has exclusively used an R2-certified recycler to recycle the Lab's electronics that have reached end of life. Even before certifications were available, ORNL had processes in place to reuse and recycle electronics in an environmentally sound manner by doing on-site assessments of the recycling facilities. In addition to the on-site assessments, ORNL also performed reviews of the recyclers' procedures and certifications for compliance with all regulations, evaluations of their operations compared to best practices, and verifications that the recyclers are in good standing with professional recycling associations. In acknowledgment of its success, ORNL received a 2014 Federal Green Challenge National Award in the electronics category for its sustainable electronics stewardship efforts and specifically for using an R2-certified recycler to recycle its electronics.

Plans and Projected Performance

ORNL's Electronic Stewardship end of life FY 2016 planned efforts include the following:

- ORNL will continue to use the CFL Program to reuse viable electronics.
- ORNL will continue to use an R2-certified recycler to recycle its electronics that have reached end of life.

Shredded electronics to be recycled by R2-certified recycler

GOAL 10: CLIMATE CHANGE RESILIENCE

10.1 Planning for Climate Change Impacts

DOE Goal: Update policies to ensure planning for, and addressing impacts of climate change.

Objective 1: Determining Risk

ORNL is taking an integrated and proactive approach to including sustainability efforts and climate change resiliency into the operational planning process. In FY 2015 the Climate Change Resiliency (CCR) Roadmap was added to the SCI Roadmaps Projects Structure. The new roadmap includes the ORNL CCR team which was chartered in

FY 2014. The team includes representatives from F&O and research programs to ensure continued collaboration and focus on the climate change topic between operations and scientific research staff. Members represent F&O senior management, site strategic planning, environmental management, natural resources, SCI, and the deputy director for the Climate Change Science Institute (CGSI) at ORNL. The roadmap owners and the CCR team held work sessions during the year to review climate change risk elements and event categories and their potential impacts to critical missions and operations, while considering our specific geographic location and associated potential risk for climate change events.

ORNL is committed to the incorporation of climate-resilient design and management elements into the planning process and to determine the specific risks and level of resiliency required. Planning steps for future activities include the following:

- Continue to develop knowledge of the impacts of climate change risks and their effects on ORNL.
- Apply this knowledge to missions and operations.
- Develop and prioritize actions based on site-specific risks and threats.
- Build awareness and improve skills to respond to potential events.

The ORNL Climate Change Resilience Risk Table is included. The CCR team will continue to review and update the table each year.

ORNL Climate Change Resilience Risk Table

	Operations			Personnel			Productivity		
Climate Hazard	Consequence	Risk	Actions	Consequence	Risk	Actions	Consequence	Risk	Actions
Average Temperature	• Increased rate of material degradation • Potential increase in disease and pests • Permit and compliance issues	L	• None		L			L	
High Temperatures	• Increased cooling costs for buildings and equipment • Decreased heating costs • Increased landscaping costs • Increased demand on equipment (e.g. chillers/substations) • Peak demand may exceed TVA contract limits or risk curtailments; resulting fees	M	• Review and analyze design standard changes • Identify impacts of discharged heat in White Oak Creek through engineering study	• Increased heat-related illness (outdoor/field work) • Reduced building thermal comfort	L		• Increased heat-related illness (outdoor/field work) • Loss of productive working hours	L	
Average Rainfall	• Strain on sewage and wastewater treatment plants	L	• Update and increase design capacity of sewage and wastewater treatment plants • Change policy to include climate change actions in future designs (SBMS)		L			L	

	Operations			Personnel			Productivity		
Climate Hazard	Consequence	Risk	Actions	Consequence	Risk	Actions	Consequence	Risk	Actions
Heavy Rainfall	• Potential flooding from White Oak Creek • Increased water damage to buildings, equipment, utilities • Operational delays due to weather • Unintended remobilization of unearthed hazardous materials • Possible permit violations and increased costs for White Oak Creek	M	• Modify flow restrictions in White Oak Creek • Ensure debris is removed from White Oak Creek to reduce overflow into facilities through the established Preventative Maintenance system • Ensure pumps are in place to displace flood waters • Rework emergency plans to include handling "flooding situations" • Run sensitivity analysis on all land use and planning variables	• Increased potential of flood-related injury/death • Reduced site access; longer commuting times	L		• Increased rate of flood-related injury/death • Reduced site access; longer commuting times • Loss of productive working hours	L	
Severe Weather (Droughts, Thunderstorms, Tornadoes, Hail, Ice, Heavy Snow, Wildfire)	• Increased landscaping costs • Potential inability to access water from Melton Lake due to droughts • Increased risk of wild fires • Increased damage to buildings and/or equipment • Impacted electrical reliability • Increased safety risks • Increased damage/maintenance costs • Increased operational delays due to weather	M	• Confirm wildfire protection plans are adequate: – Emergency Action Level Plans in place – Master Agreements in place with neighboring agencies – Current Actions in place • Confirm safety practices are adequate: – Procedures, regular drills, public address announcements – Wide Area Rapid Notification System in place – "Alert Us" system in place	• Reduced site access; longer commuting times	L		• Loss of productive working hours	L	

Objective 2: Current Activities

In conjunction with the ORNL CCR team meetings that worked to determine the risks in Objective 2, ORNL is undertaking activities that seek to address climate events that could impact critical missions, operations, and personnel. Care is being taken to increase awareness of climate change issues in programs responsible for facility operations, emergency planning and response, environmental protection, and natural resource management. ORNL is working to identify systems and programs that may need to be enhanced to address applicable risk categories. The CCR team is in the evaluation stage and is considering which policies/procedures need to be added or modified to address the risk elements identified.

In FY 2015 the CCR team discussed the importance of the federal governments' leadership in climate change resiliency and reviewed the implementation guidelines of climate change issues in the new EO 13693. The team also reviewed the findings of the DOE Vulnerability Assessment and the SPO Summary for the DOE Climate Extremes and Impacts Survey Results.

The Natural Resources Sustainable Landscaping/Land Use Team developed the *Parking Structure Mitigation Report 2015* covering mitigation sites including White Oak Creek near the High Temperature Materials Lab (HTML). This portion of the creek is one of the areas used

as mitigation for wetlands that were impacted when the parking structures were built. The team has developed a stream enhancement plan for two portions of White Oak Creek. The removal of invasive plants and increased native shrubs for forbs will help with water infiltration.

Objective 3: Future Activities

As a result of establishing the CCR team, ORNL is better positioned to address the need for climate change resiliency elements in all future plans. The team will continue to ensure that the appropriate events and risk elements are considered as part of ORNL programs and planning activities. Policies and procedures will be evaluated to determine whether they should be modified to consider climate risks.

Processes and actions for future activities include the following (for both new and existing buildings):

- Incorporate resilient design and management into the ORNL facilities planning process.
- Identify and evaluate vulnerabilities to natural hazard risks (e.g., storm events, flooding).
- Consider flood-proofing strategies and designs.
- Consider designs for enhanced wind resistance.
- Assure continuity of operations and access to electricity in the event of an extended power outage.
- Improve energy performance of building envelopes and provide for occupant comfort in the event of power outages.
- As appropriate, use information modeling to assess design options and improve decisions based on life cycle analysis.
- When cost-effective, adopt passive and natural design strategies over active and mechanical systems.

The Natural Resources Sustainable Landscaping/Land Use Team is considering a plan that includes the enhancement of the SNS retention ponds. There is a lot of potential for attractive landscape with native plants, the remove of invasive plants, increased water infiltration, and the creation of wildlife habitat, including pollinators. It will also result in a nice exercise loop for employees in the SNS area.

Objective 4: Real Property and Supply Chain Resilience

The incorporation of Objectives 1, 2, 3, and 5 into ORNL policies and procedures will ensure that climate change adaptation and resilience objectives are included in procurement, acquisition, real property, and/or leasing decisions.

Objective 5: Regional and Local Coordination

ORNL has numerous agreements in place with state, local counties, communities, and regional agencies to address the importance of coordination in emergency response and preparedness. These include the Tennessee Department of Environment and Conservation, the City of Oak Ridge and Roane County fire departments, emergency medical services, and other first responders.

Objective 6: Removing and Reforming Barriers

No high-level or critical barriers were identified as part of the initial climate change risk assessment. However, the following are "Medium Risk" actions that the ORNL CCR Team will pursue. Currently a team that comprises a stream ecologist, environmental compliance staff, the manager for reservation natural resources, and roads and ground staff has been assembled to review a stream that flows through parts of ORNL. The team is tasked to identify any impediments or catchments for debris that would cause backup or reduced flow within the stream. A preventive maintenance annual report will be written after all data and findings are collected.

White Oak Creek near the HTML parking garage

Removal of debris from creeks and streams can help control flooding events

ORNL Climate Change Risks and Actions

Consequence	Actions
Increased cooling costs for buildings and equipment	Review and analyze design standard changes
Decreased heating costs	Identify impacts of discharged heat in White Oak Creek through an engineering study
Potential flooding from White Oak Creek	Modify flow restrictions in White Oak Creek, enhance native vegetation and remove invasive plants
Increased water damage to buildings, equipment, utilities	Ensure debris is removed from White Oak Creek to reduce overflow into facilities
Operational delays due to weather	Ensure pumps are in place to displace flood waters
Bypassed permits on water limits	Rework emergency plans to include handling "flooding situations" Run sensitivity analysis on all land use and planning variables
Increased landscaping costs	Confirm wildfire protection plans are adequate

10.2 Emergency Response

DOE Goal: Update emergency response procedures and protocols to account for projected climate change, including extreme weather events.

As discussed in Objective 5, ORNL has engaged with state, local, and regional entities to address emergency response and preparedness. These include the Tennessee Department of Environment and Conservation; the City of Oak Ridge; and the Roane County fire departments, emergency medical services, and first responders. In addition, ORNL's science research staff in the Impacts, Adaptation, and Vulnerability (IAV) team develop analysis tools and methods for assessing adaptation strategies for stakeholders who must prepare people and infrastructure for the risks associated with climate change. Many of these methods span multiple scales, from local to global, and rely on advanced computer models and diverse datasets that include social, political, economic, and environmental, assessments. The IAV group works with local governments at home and abroad on climate change assessments, analyzes the resilience of the nation's energy infrastructures to climate risks, and aids in the development of regional climate models needed by local decision makers.

10.3 Workforce Health and Safety

DOE Goal: Ensure workforce protocols and policies reflect projected human health and safety impacts of climate change.

One area of concern and key focus for ORNL is staff safety during inclement weather in the winter months. During the winter of 2015, ORNL and surrounding communities received a combination of ice, snow, and single-digit temperatures, making travel to ORNL hazardous on some

Winter visits ORNL

days. However, ORNL made various arrangements to accommodate staff members who had to determine what would be best, given their particular circumstances, whether at work or at home. We advised supervisors to work with staff to the maximum extent allowed, and flexible work schedules are in place to allow staff members who are eligible to make up missed time, including allowing staff to telework from home where possible. More than 1,000 staff worked remotely during a two-week period after choosing not to travel to the Lab during periods of extreme travel conditions. ORNL has several communication protocols in place for staff to receive more timely and precise communications about Lab conditions, which allow them to make safe choices to either telework from home or travel to their on-site office. Such communication tools include:

- The ORNL Weather Line.
- ORNL Today.
- Laboratory Shift Superintendent Wide Area Rapid Notification (WARN) notices. Staff may signup to receive messages from the WARN system directly to their cell phones, home phones, and by email.
- Online Procedure: Absences Related to Weather, Adverse Events, and the Laboratory's Operational Status.
- A more formalized system of identifying priority areas for snow removal. We instituted the system in FY 2015 and published those areas on a map that was distributed to staff.

10.4 Management Commitment

DOE Goal: Ensure site/lab management demonstrates commitment to adaptation efforts through internal communications and policies.

ORNL has a strong commitment to adaptation efforts and to communicating existing and new policies to the staff. In FY 2014, ORNL chartered the CCR team. The team's mission is to ensure continued collaboration and to communicate information on the topic of resiliency to operations and scientific research staff. The team is composed of F&O senior managers; utilities managers; staff in site strategic planning, environmental management, and natural resources; the SCI; and the deputy director for the CCSI. The CCR team held a working session in FY 2015 to review ORNL's Climate Change Risks and Actions and to ensure that actions noted in FY 2014 were being addressed, to review existing policies, and to discuss the newly issued EO 13693 and ORNL's continued implementation plans for moving forward pertaining to CCR.

Additionally, Laboratory Director Thom Mason provides monthly messages containing updates on a multitude of current topics. Always included is a safety message, answers to staff concerns, explanations for decisions made such as why ORNL remained opened during inclement weather, and updates that keep the staff informed. In addition to holding regular monthly and expanded quarterly meetings with all ORNL managers, Dr. Mason has a blog and a Twitter account, and staff members are encouraged to post comments, concerns, and questions on any topic. Their comments are addressed in an expeditious manner.

10.5 Policies and Programs

DOE Goal: Ensure that site/lab climate adaptation and resilience policies and programs reflect best available current climate change science, updated as necessary.

As mentioned in Section 10.4, ORNL has an active CCR team in place to review, modify, and create new policies and programs to ensure that ORNL is a leader in this area.

In addition, ORNL has the CCSI, a unique, dedicated institution within the national laboratory system and across the country, composed of approximately 130 scientists and co-located in a single modern, open office space. CCSI's priorities are to create the science, experiments, data, and community capacity needed to:

- strengthen the predictive capabilities and effectiveness of climate and biogeochemical models,
- identify and understand how extreme events and climate tipping points impact the resiliency of human and natural land-energy-water systems,
- participate in national and international climate assessments and response option analysis, and
- develop useful climate adaptation and mitigation tools and information in collaboration with land-energy-water system stakeholders.

Also, the ORNL Climate Extremes, Uncertainty & Impacts website provides a listing of projects, publications, collaborators, job openings, and staff contacts.

Additionally, the Old-Field Community Climate and Atmospheric Manipulation, a joint project between ORNL and UT, has been organized to investigate community and ecosystem response to global change, in particular, interactive effects of atmospheric carbon dioxide and surface temperatures and soil moisture.

ORNL SCI team members and leadership team champions

Earth Day 2015 at ORNL

In April ORNL employees were invited to participate in Earth Day. The Earth Day theme of "Spring into Healthy, Safe, Sustainable Living" was just the kick-off of an effort to improve sustainability performance during 2015. The Sustainable Campus Initiative partnered with the Pollution Prevention Program, Health and Wellness, Fire Protection, Property Management, Energy Management, Sustainable Transportation, and the Network Printing Initiative to highlight a number of programs designed to increase employee awareness and participation. Participants were encouraged to join a wellness program, make their offices safer places to work, convert to network printing, get rid of old equipment, recycle, and develop healthy and sustainable habits.

Earth Day began with a seminar presented by local expert Neal Denton on "Improving Soils through Composting." Neal is a home-grown WBIR celebrity and well-known extension agent with University of Tennessee/Tennessee State Extension–Knox County.

Sponsoring Organizations and Messages for Earth Day 2015

1. Pollution Prevention Program, Emphasis on "Recycling" goals:
   - encourage office spring cleaning
   - introduce the new shredding contractor
   - promote the continued use of desk-side recycling whenever possible
2. Health and Wellness Program, Encourage Healthy Living:
   - Information on the benefits of Healthy Eating; less processed foods, less packaging, better nutrition, and better health
   - Get Out and Move: Promote the 5K Wellness Run/Walk
3. Network printing: Information on the benefits of network printing. Better quality; use of less material (toner, print cartridges); better energy efficiency; and less cost per page than most desk-side printers
4. Safety and Fire Prevention: Keep offices clean (free of unneeded papers, notebooks, supplies, excess or outdated equipment, freeing tripping hazards, and general clutter) and the importance to safety, fire prevention, and emergency response efforts
5. Energy efficiency: Information on the importance of energy efficiency efforts, the results of prior efforts, an interactive displays on ORNL building energy use
6. eProp support: What are good items for eProp, how to eProp appropriate equipment, what can you expect from the process
7. Sustainable Transportation: Demonstrate our most efficient fleet vehicles. A staff member's Tesla was a real head-turner, showing us how to be super-efficient and super-stylish
8. Sustainable Campus Initiative: Provide information about SCI and help to promote the importance of recycling in 2015. Make sure everyone leaves the displays with a sustainable living promotional item

ORNL Health and Wellness Program

Since its inception, the SCI has partnered with the ORNL Wellness Program as a recognized best practice for sustainable organizations. ORNL senior leadership, one of the keys to program success, and senior managers are often represented at the Wellness events. FY 2015 performance includes following:

- As a result of a partnership effort between the Wellness Program and the SCI, a new commercial-size blood pressure machine was installed for staff at the US ITER Project office at ORNL. We now have six machines throughout the campus.
- Health Fest, which takes place in the month of May, is a popular means for encouraging physical activity and movement among the employee population, many of whom have sedentary jobs. Participants receive Reward Points for each activity, which, along with a health assessment, can earn a reduction in the cost of ORNL medical plan premiums. During the FY 2015 Health Fest Kick-off event, the Wellness team partnered with SCI which provided pedometers, recyclable lunch bags, tire gages for bikes, and healthy almonds snacks for the participants. Thirty activities were organized by the Wellness Program, including Zumba, yoga, and 5K/10K walk/runs. Activities such as chair yoga, chair exercise, and presentations were also made available for those who are disabled or handicapped.
- For the ninth year, the ORNL Wellness Program offered the Mayo Clinic Health Assessment and for the sixth year offered the Reward Points Plus Program. Participation is on trend to increase over FY 2014 numbers. The 5-year cohort data indicate improvements in safety and nutrition and reductions in cholesterol levels and tobacco consumption. Unhealthy trends were seen for blood pressure, blood sugar, and weight.

  The FY 2015 campaign will end October 30, 2015. The following statistics are current as of October 7, 2015:

  - Healthy Living portal registration: 2,012
  - Health Assessment completions: 1,392
  - Health Assessments in progress: 292
  - Reward Points completion: 1,545

- Two of the most effective programs sponsored by the Wellness Program are the annual Biggest Loser Team Challenge and the Santaclaustrophobia Challenge, both of which are weight management programs. For the Biggest Loser Team Challenge each participant pays a $10 entry fee and the top three teams (i.e., those who lose the most weight based on percentage of weight loss) split the purse. The individual challenge ($10 entry fee) and maintenance challenge (no fee) are also available. This year, the Biggest Loser Team Challenge was renamed the "Biggest Loser Lifestyle Challenge" to encourage employees to change their lifestyles, not just go on a diet for 12 weeks. This the year, half the purse was awarded at the completion of 12 week program and the other half will be awarded at the weigh in of the Santaclaustrophobia Challenge (late November) for those who maintain their weigh lose over the seven months (allowing a 2 lb. gain). This encourages the lifestyle of eating healthy, exercising and maintaining the weight loss over several months and hopefully for a life time. The Santaclaustrophobia Challenge draws some 700 to 800 employees to participate, and at least 80% meet the goal of not gaining more the 2 lbs over the Thanksgiving to New Year's holidays.

- New addition to the ORNL Wellness Program will be the Group Fitness classes. These are intended to enhance the fitness levels of the employees and to reduce stress. Class such as spin, yoga, tai chi, strength training, Pilates, step, and PiYo will be taught at various times of the day for the employees. Space for group fitness classes is in the renovation stage, transforming 2 lab spaces in Building 4500S into a group fitness room.
- In FY 2015, the ORNL Wellness Programs continued to support the Reward Points Plus Program with the Health Series lectures, screenings, and challenges/programs. Under that umbrella, the wellness program brings in professional speakers to address the health topics that are most timely and interesting to our employees and that are requested by them. These two monthly health series creates awareness and educates the ORNL population on the most prevalent risk factors at ORNL. Attendance in most sessions exceeded FY 2014 attendance rates. Lecture titles included "Foot Injuries," "Understanding Common Thyroid Disorders," and "Caring for your Senior." Local physicians also gave talks on topics such as food as preventive medicine, how to get healthy now and help prevent future illness, Crohn's Disease, and colitis. Along with the lectures, several meditation sessions were held to address stress among the employees.
- In celebration of Earth Day, ORNL Wellness Program teamed with SCI to sponsor a 5K/10K run/walk. About 100 employees participated in the event.
- As co-chair of the FY 2015 Benefits and Wellness Fair, the ORNL Wellness program manager conducted oversight, organizing and coordinated the participation of 100 vendors to provide the most current and best available information for ORNL employees.

III. Fleet Management Plan

A. Fleet Management Organization Structure

The ORNL Fleet Management's structure is part of Fleet and Transportation Services in the Logistical Services Division (LSD). LSD reports to the F&O Directorate.

B. Fleet Procurement

Vehicles are chosen for replacement based on the Federal Replacement Standards (41 CFR 102-34.280), which states the minimum miles and age of a vehicle that can be replaced. In addition, the maintenance costs and the mission that the vehicle supports are also part of the criteria for choosing vehicle replacement.

Authority for the acquisition of passenger-carrying vehicles is contained in the annual Appropriation Act and is provided through the DOE ORO fleet manager. Vehicle acquisition approvals are granted by ORNL's DOE Site Office Operations and the ORO fleet manager.

C. Fuel Infrastructure

ORNL's fueling infrastructure makes available four types of fuel, unleaded, E85, diesel, and biodiesel. There are no barriers in acquiring vehicles as long as they can use one of those types of fuels. ORNL has an effective fueling infrastructure for AFVs.

D. Vehicle Use Policies

Vehicles are provided to divisions based on their mission's needs. The vehicles are then given to the appropriate group within that division. Vehicles can then be assigned as a pool vehicle, where several employees utilize the vehicle, or it can be assigned to one or several employees as an operational vehicle. Operational vehicles are used by craft crews such as pipefitters, carpenters, painters, and grounds maintenance personnel to maintain ORNL's buildings and grounds infrastructures. ORNL has a sitewide procedure that describes the requirements and rules for use of government-owned vehicles.

ORNL currently employs vehicle telematics for one of the plug-in hybrid fleet vehicles which track use, performance, and charging data. Telematics were also installed in one of the non-plug-in hybrid fleet vehicles.

Through ORNL on-site communication channels, employees are advised to avoid idling of vehicles. Also, posters are displayed as reminders to drivers to follow the anti-idling guidance.

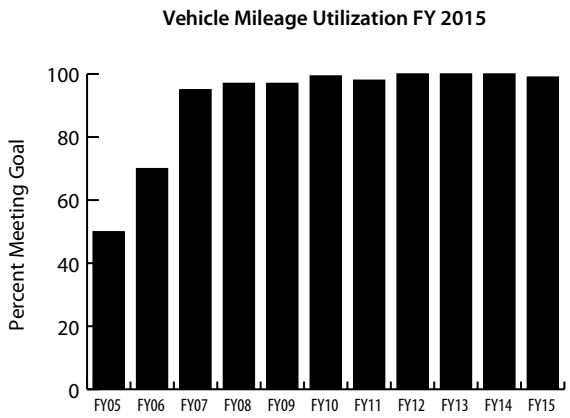
ORNL is required through the ORO fleet manager to meet an annual motor vehicle local-utilization goal of 94%. ORNL's local-use objectives are summarized in the table; the outcomes are shown in the figure. Each year, a certain mileage requirement is assigned per vehicle and is submitted to the ORO fleet manager in an annual report. If a vehicle does not meet this mileage requirement, justification is required as to why a vehicle needs to be retained in the fleet.

ORNL local use objectives for FY 2015

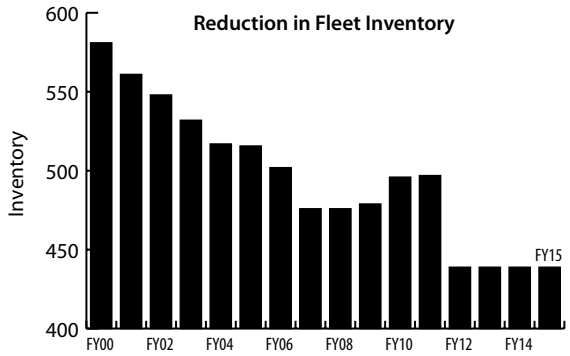
Vehicle category	Local use goals (Miles required per fiscal year)
Small geographical area	1200
Operations/maintenance	1500
DOE Site Office	1200
Buses/taxis	3000
Special purpose	No mileage standard—justification required

ORNL has worked closely with DOE and ORO to right-size the ORNL vehicle fleet. In support of the 2012 fleet reduction initiative, ORNL reduced its fleet by 58 vehicles, bringing the total fleet count to 439. ORNL has reduced its fleet ceiling and maintained the current ceiling based upon mission criticality, as indicated in the figure. All 439 vehicles are deemed to be necessary for the safe and cost-effective operation of ORNL facilities and missions and are assigned to critical functions. Additional reductions would impede critical mission elements or the ability to provide a safe, secure, and environmentally sound work environment. ORNL is the largest DOE science and energy laboratory, conducting basic and applied research to deliver solutions to compelling problems in energy and security. These vehicles support a 50-square mile site with more than 4,500 employees and with another 3,200 users and visiting scientists coming to ORNL annually. Based on utilization being above 99.8% since 2012, ORNL has no plans to increase or decrease its fleet size during the next fiscal year.

ORNL has been aggressively and effectively managing its fleet since 2000. It has pursued vehicle reductions; converted to alternative fuels; and modernized the fleet. In addition, ORNL employees continue to utilize alternative modes of transportation such as taxis, low-speed vehicles (electric and biodiesel), a fleet of shared bicycles, and convenient walking paths.



ORNL vehicle mileage utilization FY 2005 through FY 2015.



ORNL vehicle inventory from FY 2000 through FY 2015.

IV. Funding

ORNL assesses the environmental, economic, and social benefits of proposed activities on an individual, project-specific basis. Through the Mission Readiness process, ORNL determines the ability of its facilities and infrastructure to accomplish mission objectives now and in the future. Projects are identified to further the safe, compliant, efficient accomplishment of mission objectives, including sustainable operations. Funding sources for projects are evaluated and established considering all available and appropriate funding venues, including private sector financing, cost sharing, institutional investment, and programmatic appropriations. Allocation of funds is based on multiple considerations, including mission impact, sustainability, and return on investment.

ORNL's SCI managed 25 dynamic roadmaps in FY 2015 all at varying stages of implementation. Each roadmap has specific fiscal year deliverables that are kept on schedule through regular review meetings held between individual roadmap owners and the SCI leadership. In addition, the F&O director, an SCI sponsor, has made success on these roadmaps a part of the directorate's performance plan. All roadmaps are also reviewed with the SCI sponsors (from the ORNL SCI Leadership Team) on a quarterly basis. This scheduled review also provides a forum for presenting new roadmap proposals developed by ORNL staff.

Opportunities for ECMs are routinely considered and are screened by facility managers and engineers before being selected. In addition to technical and energy savings feasibility, each project is analyzed in terms of financial return. Most of the projects considered good candidates for ECMs have a financial payback estimate of less than 2 years.

In late October ORNL was notified of an SPO-funded award that will be applied to continued progress in the areas of HPSB. The project will start in December 2015 with work planned for completion in October 2017. Both the SPO funded portion and the ORNL matching funds for this project will occur in FY 2016 and FY 2017.

In March 2015 the DOE Financial Management Handbook was updated to support the DOE Policy for the Reinvestment of Cost Savings from Sustainability Projects as required by DOE Order 436.1. The guidance was issued to assure that all sites develop plans to reinvest monetary savings to fund ongoing sustainability projects that meet qualifying objectives. SCI members worked with the F&O finance officer to develop an implementation strategy and update internal ORNL policies. Funds for reinvestment can come from a variety of operating sources such as DOE, SPO, SC, and site F&O funds but not from third-party contracts such as ESPCs. ORNL SCI members also initiated an informal working group with other labs and continues to schedule conference calls to strategize on ways to share ideas on how to effectively track projects and improve processes for the reinvestment of cost savings for sustainability projects.

ORNL Summary of Sustainability Project Funding ($K)

Category	FY 15 Actual	FY 16 Planned/Request	FY 16 Projected	FY 17 Projected
Sustainability Projects*	$ 641	$ 650	$ 650	$ 800
Sustainability Activities other than projects	Captured in	Sustainability Projects	Budgets	
ECMs (Energy/water efficiency)	$ 1,794	$ 2,035	$ 2,100	$ 2,200
SPO-Funded Projects (SPO-funded portion only)	$ 0	$ 149	$ 149	$ 102
Site Contribution to SPO-Funded Projects	$ 0	$ 71	$71	$ 49
ESPC/UESC Contract Payments	$ 9,396	$ 9,702	$ 9,702	$ 10,021
REC Purchase Costs	$ 61	$ 107	$ 107	$ 110
Total	**$11,892**	**$12,714**	**$12,799**	**$13,282**

*Projects specifically funded to meet sustainability goals.

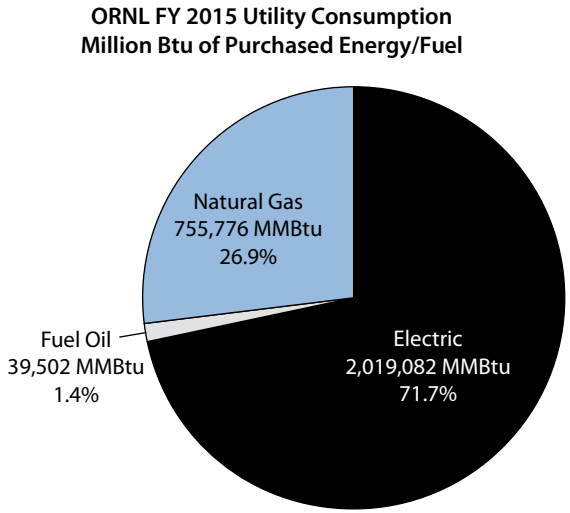
V. Electrical Energy and Utility Cost Projections and High-Energy Mission-Specific Facilities

ORNL's utility services include electrical power, steam, chilled water, and potable/process water to support ORNL's mission and the research community. Electrical services include basic power needs as well as chilled water service and direct cooling applications. Steam is generated from a combination of fuel oil and natural gas. Natural gas and fuel oil are also used in direct heating applications. Potable water usage supports mission-critical process applications as well as domestic water use, including restrooms and drinking water.

Utility Usage

Electricity is the largest energy commodity for ORNL, at 72% of the total energy consumption (in million Btu). Electrical services dominate ORNL's energy, primarily due to critical operations at high-energy mission-specific facilities (HEMSFs). In FY 2015, the HEMSF buildings consumed 71% of ORNL's electrical energy; and current projections show an increase to 81% by the FY 2025 target/goal year. HEMSF buildings currently consume 52% of all ORNL water, and that number is expected to rise to 71% by FY 2025.

The Biomass Gasification Steam System was replaced by a dual-fuel boiler (natural gas and fuel oil) in September 2015. Two additional, similar boilers are being commissioned to replace two aging existing boilers. Natural gas is also used for the Melton Valley Steam Plant, SNS, and other direct heating/research applications for a total of 27% of energy consumption. Fuel oil was used for steam generation during curtailment and maintenance periods as well as direct heating applications and emergency generator services for 1.4% of the energy consumed.

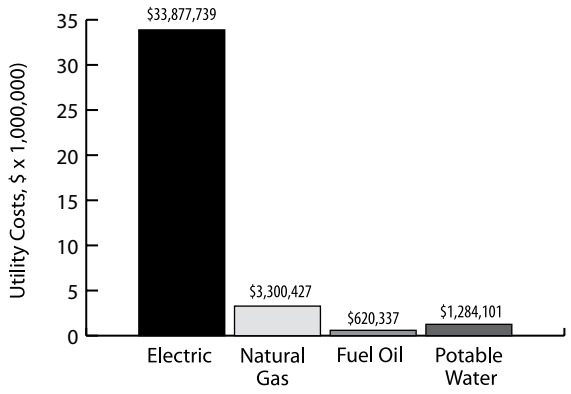


FY 2015 utility energy consumption and percentages.

Utility Costs

As electricity is by far ORNL's largest purchased energy source, it is also the most costly at $33,877,739 in FY 2015. ORNL uses the TVA seasonal manufacturing rate for the best value based on its high and consistent demand load. SNS uses TVA's seasonal time-of-use rate to take advantage of process cycles and scheduling within the rate structure.

Natural gas and fuel oil follow electricity, with respective costs of $3,300,427 and $620,337. Water is the next largest purchased commodity at $1,284,101 in FY 2015.



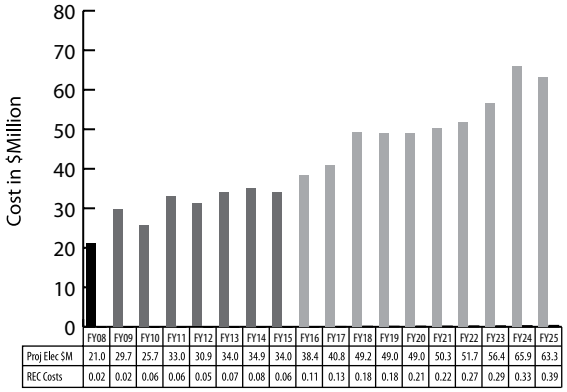
ORNL utility costs for FY 2015

Electrical Cost Projections

TVA rate structures include basic rate components for demand and energy. In FY 2016, ORNL will begin using a new Strategic Pricing Plan Time-of-Use rate, rather than a seasonal demand and energy rate. Both ORNL and SNS will utilize the time-of-use rate, which will incentivize off-peak energy consumption. Even without demand or peak-shift actions, this new rate structure is expected to be economically favorable to ORNL. The major factor in the overall rate, total fuel cost, will remain a variable that accounts for the fuel mix TVA uses to generate power and will change each month with respect to the fuel mix consumed. TVA's Strategic Pricing Plan will help levelize this cost-recovery component in FY 2016. TVA strives to provide competitive electrical rates and to improve its fuel mix for positive economic and environmental benefits to its customers.

The projected electrical energy and REC cost graph includes anticipated TVA rate increases and indicates a strong growth in electrical consumption for HEMSFs through FY 2025.

In addition to the electrical energy costs, ORNL will also purchase RECs to meet and/or exceed the Renewable Energy Target and the Clean Energy Target. REC purchases will be made from TVA's Southeastern REC Pilot program and from the open market utilizing ORNL's strategic purchasing guidance. The renewable targets will increase each year to reach their respective final FY 2025 goals, which also complement the increasing energy consumption; therefore the costs will rise significantly by the FY 2025 period. See the Projected Electrical Energy and REC cost graph for both historical data and estimated cost by year.



ORNL projected electrical energy cost.

High-Energy Mission-Specific Facilities

ORNL has defined four facilities as HEMSFs. These facilities use a substantial portion of ORNL's total electrical power. In the DOE goal baseline year of FY 2008, they consumed 194,751 MWh, more than half of all ORNL power consumption. By the GHG reduction target year of FY 2025, ORNL's HEMSFs are projected to use 651,395 MWh, accounting for about 81% of all power consumed on the site.

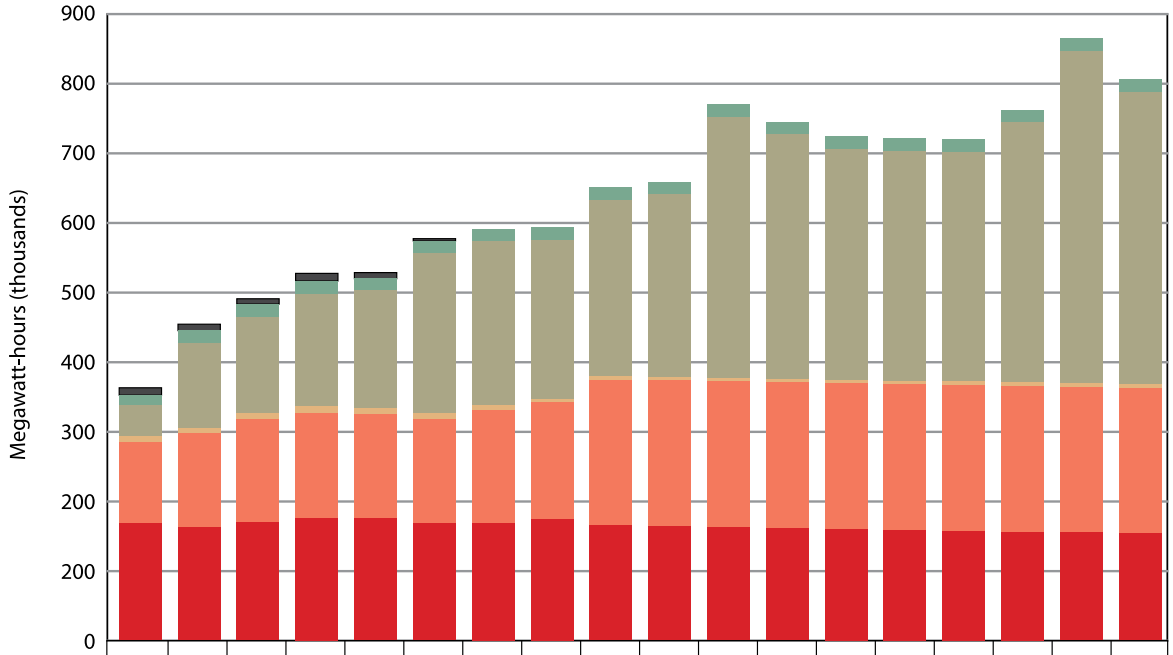
The ORNL HEMSF utility consumption graph (compared with base site usage) illustrates the historical and projected power consumption for ORNL's HEMSFs, all of which are designated as excluded facilities in the DOE FIMS database. The following is a list of ORNL HEMSFs with definitions; a brief narrative describing each facility is included in this section. The HRIBF has been removed from the current HEMSF inventory due to a major reduction in mission, but is shown in the graph for historical comparison purposes.

Identification of ORNL HEMSFs:

HFIR	High Flux Isotope Reactor	Fission Reactor
HPC	High Performance Computing	User Facilities
SNS	Spallation Neutron Source	Accelerator
CNMS	Center for Nanophase Materials Sciences	Nanoscience Facility
Base Site Usage	Power usage in addition to that of HEMSFs	Offices/Labs/ Support

Facility Summary and Update on Electrical Projections

Beginning in FY 2018 significant growth is projected for the HPC areas. It anticipates an 84% boost in technical power by FY 2025 above FY 2015 power levels, showing a 64% growth rate by FY 2018 and peaking in FY 2024. Research activities at SNS are also expected to increase in FY 2016 and beyond. ORNL anticipates an increase in campus development, further escalating electrical demand going forward. The new development is expected to be in the form of energy-efficient facilities, and efforts to transition from older, less-efficient facilities will continue in order to optimize campus energy consumption.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025
HRIBF	10,582	9,212	7,620	10,955	8,780	3,238	-	-	-	-	-	-	-	-	-	-	-	-
HFIR	13,557	17,611	18,298	18,700	17,233	17,102	17,546	17,981	17,981	17,981	17,981	17,981	17,981	17,981	17,981	17,981	17,981	17,981
HPC	45,586	121,470	138,293	161,465	168,460	230,067	233,882	228,706	253,015	262,245	374,958	351,275	331,432	329,741	329,741	373,395	477,026	419,707
CNMS	8,147	8,311	8,075	8,828	8,413	8,230	8,328	4,519	4,519	4,519	4,519	4,519	4,519	4,519	4,519	4,519	4,519	4,519
SNS	116,879	135,138	148,457	151,058	149,937	149,978	161,348	166,414	209,188	209,188	209,188	209,188	209,188	209,188	209,188	209,188	209,188	209,188
Base Site Usage	167,274	161,437	168,902	175,049	174,359	167,216	168,230	174,139	164,532	163,248	161,916	160,491	159,246	157,989	156,730	155,502	154,279	153,066

High Flux Isotope Reactor

Operating at 85 MW, the High Flux Isotope Reactor (HFIR) provides one of the highest continuous fluxes of neutrons of any research reactor in the world, and its cold source is the brightest in the world. The neutron scattering research facilities at HFIR include 15 world-class instruments either in operation or planned, including two cold source instruments. The thermal and cold neutrons produced by HFIR allow scientists to study the molecular and magnetic structures and behavior of a variety of materials, including high-temperature superconductors, polymers, metals, and biological samples. These studies are leading to scientific and technical advances in a wide range of fields, such as physics, chemistry, materials science, engineering, and biology. The reactor is also used for isotope production, materials irradiation, and neutron activation analysis.

HPC - Computational Sciences Building

The High Performance Computing mission includes the Computational Sciences Building (CSB), part of the Oak Ridge Leadership Computing Facility (OLCF) established at ORNL in 2004 with the mission of standing up a supercomputer 100 times more powerful than the leading systems of the day. Since that time, ORNL has more than met that goal, producing a number of supercomputers, each bearing the title "world's fastest computer" in its time.

In November 2012, Titan was named the world's fastest computer at 17.59 sustained petaflops—ten times faster than its predecessor. In 2015, Titan remains the second-fastest computer in the world on the Top 500 list. Equally important, Titan demonstrates very high energy performance of more than 2,100 megaflops per watt, one of the most efficient computers in the world for a system of its size.

As a result, OLCF gives the world's most advanced computational researchers an opportunity to tackle problems that would be unthinkable on other systems. The facility welcomes investigators from universities, government agencies, and industry who are prepared to perform breakthrough research in areas running the gamut of scientific inquiry. Because of its unique resources and capabilities, OLCF focuses on the most ambitious research projects—projects that provide important new knowledge or enable important new technologies and that cannot be accomplished anywhere else.

On November 14, 2014, Dr. Mason joined Energy Secretary Moniz and members of Congress on Capitol Hill for the announcement of DOE's newest supercomputers, Summit at ORNL and Sierra at LLNL. The ORNL project includes both the acquisition of Summit, an IBM POWER9 system, and the construction of a new 20 MW computing facility. The facility construction is well under way, with substantial completion in 2016. ORNL's IBM system is expected to be available to users in 2018. Summit will be at least five times as powerful as Titan while still maintaining a similar carbon footprint.

Spallation Neutron Source

SNS is an accelerator-based neutron source that provides the most intense pulsed neutron beams in the world for scientific research and industrial development. SNS is a versatile scientific tool that gives researchers more detailed snapshots of smaller samples of physical and biological materials than ever before possible. With resources that will eventually include 25 best-in-class instruments, scientists can count scattered neutrons, measure their energies and the angles at which they scatter, and map their final positions. SNS allows measurements of greater sensitivity, higher speed, higher resolution, and in more complex sample environments than had been possible at the existing neutron facilities. The diverse applications of neutron scattering research are providing opportunities for research on the structure and dynamics of materials in practically every scientific and technical field. For FY 2015, the SNS delivered a total of 4,441.1 hours of neutron production with a delivery of 94.49% according to the DOE Performance Measure Manager Reporting Requirements.

Center for Nanophase Materials Sciences

The Center for Nanophase Materials Sciences (CNMS), co-located with SNS on the Chestnut Ridge part of the ORNL campus, offers expertise and instrumentation for user research in a broad range of disciplines that address forefront research in nanoscience, nanotechnology, and related phenomena. CNMS integrates nanoscale science with neutron science; synthesis science; and theory, modeling, and simulation. The facility is equipped with a wide range of specialized tools for synthesis, characterization, and fabrication of nanoscale materials and assemblies, including the integration of hard and soft materials.

Appendix A: Excluded Buildings Self-Certification Process

DOE BUILDING EXCLUSION
SELF-CERTIFICATION FORM
FY 2015

FROM: Oak Ridge National Laboratory
Johnny O. Moore, Manager
Oak Ridge Site Office

TO: Sustainability Performance Office
DATE: November 30, 2015
SUBJECT: Self-Certification Form for the Energy Intensity Goal of EISA 2007

Each buildings or group of buildings excluded under the criteria for a Part G or Part H exclusion is/are metered for energy consumption and their consumption is reported annually.

No buildings have been excluded under Part H. If they had been, then all practicable energy and water conservation measures with a payback of less than 10 years would have been installed. A justification statement explaining why process-dedicated energy in the facility may impact the ability to meet the goal would have been provided in the FIMS Report 063.

I certify that the buildings listed on the Excluded Buildings List produced by FIMS as Report 063 dated November 12, 2015 for Oak Ridge National Laboratory and listed on pages 2 through 5 below meet the exclusion criteria in Guidelines Establishing Criteria for Excluding Buildings published by FEMP on January 27, 2006.

Johnny O. Moore
_____
DOE Site Office Official – printed name

_____
DOE Site Office Official – signature

_____
Date

Contact:
Mary H. Rawlins
Federal Project Director
Phone: (865) 576-4507
Email: rawlinsmh@ornl.gov

Name of Building(s) from FIMS data base (Property Name)	FIMS - Property Sequence Number	Part (check one)							Comments
		B	C	D	E	F	G	H	
National Energy Security Center	2040		X						Fully-Serviced Lease. Tennant cannot make changes to building infrastructure for energy reductions.
Biosciences Division	102GRAND		X						Fully-Serviced Lease. Tennant cannot make changes to building infrastructure for energy reductions.
Excessing and Surplus Sales	115UNV		X						Fully-Serviced Lease. Tennant cannot make changes to building infrastructure for energy reductions.
Grove Center Storage	121ROBER		X						Fully-Serviced Lease. Tennant cannot make changes to building infrastructure for energy reductions.
Nat Security Dir Univ of AL, Huntsville	301SPARK		X						Fully-Serviced Lease. Tennant cannot make changes to building infrastructure for energy reductions.
Battelle Washington DC Operations Office	BWO		X						Fully-Serviced Lease. Tennant cannot make changes to building infrastructure for energy reductions.
Commercial Storage Space	NTRCSTRG		X						Fully-Serviced Lease. Tennant cannot make changes to building infrastructure for energy reductions.
161 kV Substation	0980						X		This is a primary substation for ORNL electrical power. Electrical loss across transformers is inherent in their design. Energy loads are not influenced by conventional building energy conservation measures.
Computer Center (part of Multi-Program Research Facility)	5300						X		This is a relatively new (2008) high performance computing center in the Multi-Program Research Facility. Energy is required for computational science and other missions, and energy intensity in the data center is 49 times that of standard buildings at ORNL. Significant energy reductions are not practical without affecting mission operations.
Computer Center (part of Computational Sciences Building)	5600						X		This is a relatively new (2003) modern facility with a high performance computing center. Energy is required for computational sciences research missions (i.e., supercomputing), and energy intensity in the data center is 29 times that of standard buildings at ORNL. Significant energy reductions are not practical without affecting research operations.
161 kV Substation	7640						X		This is a primary substation for ORNL electrical power. Electrical loss across transformers is inherent in their design. Energy loads are not influenced by conventional building energy conservation measures.

Name of Building(s) from FIMS data base (Property Name)	FIMS - Property Sequence Number	Part (check one)							Comments
		B	C	D	E	F	G	H	
Waste Processing Facility process buildings, as follows:	*See comment at right:*								The Waste Processing Facility (WPF) buildings listed below make up the process buildings required for transuranic (TRU) waste processing. Energy is required for the operations mission. The facility's energy intensity is about 71% higher that that of standard buildings at ORNL. Significant energy reductions are not practical without affecting TRU waste processing activities.
Waste Processing Facility	7880						X		--- see WPF comment above ---
WPF Control Room	7880D						X		--- see WPF comment above ---
WPF Boiler	7880E						X		--- see WPF comment above ---
WPF Air Compressor	7880F						X		--- see WPF comment above ---
WPF Electrical Equipment Building	7880G						X		--- see WPF comment above ---
Spallation Neutron Source (SNS) process facilities, as follows:	See comment at right:								The SNS buildings listed below make up the process buildings required for SNS operations. At full power, the SNS will provide the most intense pulsed neutron beams in the world for scientific research and industrial development. Completed in May 2006, SNS has ramped up to near full-power capability. Energy intensity is required for research missions. Energy loads are not influenced by conventional building energy conservation measures. Significant energy reductions are not practical without affecting research operations. (The Central Laboratory and Office Building at SNS are not exempt from energy goals, but only the buildings required for process operations.)
(SNS) Front End Building	8100						X		--- see SNS comment above ---
(SNS) Beam Tunnel	8200						X		--- see SNS comment above ---
(SNS) Klystron Gallery	8300						X		--- see SNS comment above ---
(SNS) Central Helium Liquifier Facility	8310						X		--- see SNS comment above ---
(SNS) Superconducting Rad Freq. Bldg.	8320						X		--- see SNS comment above ---
(SNS) RF Test Facility	8330						X		--- see SNS comment above ---
(SNS) HEBT Service Building	8340						X		--- see SNS comment above ---
(SNS) Ring HVAC Building West	8413						X		--- see SNS comment above ---
(SNS) Ring HVAC Building East	8423						X		--- see SNS comment above ---
(SNS) Ring Injection Dump	8520						X		--- see SNS comment above ---
(SNS) Ring Service Building	8540						X		--- see SNS comment above ---

Name of Building(s) from FIMS data base (Property Name)	FIMS - Property Sequence Number	Part (check one)							Comments
		B	C	D	E	F	G	H	
(SNS) RTBT Service Building	8550						X		--- see SNS comment above ---
(SNS) Target Building	8700						X		--- see SNS comment above ---
(SNS) Target Building #1 Beam Line 1	8702						X		--- see SNS comment above ---
(SNS) Target Building #1 Beam Line 5	8705						X		--- see SNS comment above ---
(SNS) Target Building #1 Beam Line 7	8707						X		--- see SNS comment above ---
(SNS) Target Building #1 Beam Line 11	8711						X		--- see SNS comment above ---
(SNS) Target Building #1 Beam Line 13	8713						X		--- see SNS comment above ---
(SNS) Target Building #1 Beam Line 14B	8714B						X		--- see SNS comment above ---
(SNS) Helium Compressor Building	8760						X		--- see SNS comment above ---
(SNS) Laboratory Support Building	8770						X		--- see SNS comment above ---
(SNS) BL-11A Gas Cylinder Storage Building	8780						X		--- see SNS comment above ---
(SNS) Switch Yard	8911						X		--- see SNS comment above ---
(SNS) Central Exhaust Facility	8915						X		--- see SNS comment above ---
(SNS) Diversion Tanks	8918						X		--- see SNS comment above ---

Appendix B: Policy and Program Statement

Policy and Program Statement

ORNL operates a Standards-Based Management System (SBMS) which serves to translate external and internal requirements into laboratorywide policies and procedures to assist staff in achieving the Laboratory's mission in a safe and compliant manner.

In support of the missions of the DOE, ORNL conducts basic and applied R&D to create scientific knowledge and technological solutions that:

strengthen the nation's leadership in key areas of science;

increase the availability of clean, abundant energy;

restore and protect the environment; and

contribute to national security.

The mission of ORNL is to deliver scientific discoveries and technical breakthroughs that will accelerate the deployment of solutions in clean energy and global security, and in doing so create economic opportunity for the nation.

The following Statement was issued by ORNL's Laboratory Director
August 25, 2014

UT-Battelle Policy for ORNL

Policies represent the philosophy of UT-Battelle for the conduct of research, operations, and other activities at ORNL. It is my expectation that all individuals performing work at the Laboratory will adhere to these policies, and that these policies will be incorporated in all activities at ORNL.

Thomas E. Mason

Director

(Signature on file)

Appendix C: ORNL Metering Plan

The ORNL Central Energy Data System (CEDS) is used to track and manage energy use at the Laboratory. Utility metering provides the system with data in support of the ORNL "measure to manage" philosophy. The data that utility meters provide are critical for a number of energy management, sustainability, and operational reasons. Utility-metering data are used to benchmark building energy and water use so that relative performance can be determined. The data are used to identify energy and water conservation opportunities and to track savings performance after a conservation measure has been implemented. Utility data can also be used as part of energy awareness campaigns and for managing energy cost accounting.

ORNL has adopted standardized specific advanced metering hardware for each utility type and uses a common communications protocol for ease of connection to CEDS. The following metering plan identifies buildings at ORNL that are considered to be "appropriate" buildings for metering as defined in the *November 2014 Update to the Federal Building Metering Guidance.* This plan identifies ORNL's current metering presence in its appropriate buildings and articulates a priority for continued growth of metering infrastructure.

Legend	
Short-term Priority: Will be metered within 1 year	TBD, Prioritization to be determined
Mid-term Priority: Will be metered within 1-3 years	Will not be metered, not an appropriate facility
Long-term Priority: Will be metered within 3-5 years	Will not be metered, not a cost-effective facility
Post Metering Plan Priority: No plans to be metered within 5 years	

Property ID	Property Name	Gross Square Feet	Electricity	Natural Gas	Steam or Hot Water	Potable Water	Chilled Water
1005	Ultra-Trace Forensic Science Center	35,973	Advanced	N/A	Not Metered	Advanced	N/A
1060	Environmental & Life Sciences Laboratory	9,516	Advanced	N/A	Advanced	Not Metered	N/A
1061	Health Protection Services Facility	6,999	Advanced	N/A	N/A	Not Metered	N/A
1062	West Office Building	6,998	Advanced	N/A	N/A	Advanced	N/A
1503	Plant Sciences Lab	17,024	Advanced	N/A	Advanced	Advanced	N/A
1504	Aquatic Ecology Laboratory	12,174	Advanced	N/A	Advanced	Advanced	N/A
1505	Environmental Science Laboratory	88,843	Advanced	N/A	Advanced	Advanced	N/A
1506	Controlled Env & Animal Bldg.	16,785	Advanced	N/A	Advanced	Advanced	N/A
1507	Life Sciences Data Analysis Bldg	6,996	Advanced	N/A	N/A	Advanced	N/A
1509	Environmental Engineering Facility	6,995	Advanced	N/A	N/A	Advanced	N/A
1521	West End Research Support Facility	9,303	Advanced	N/A	N/A	Not Metered	N/A
2007	Calibration Lab	6,781	Advanced	N/A	Not Metered	Not Metered	N/A
2026	Radioactive Materials Analytical Lab	26,640	Standard	N/A	Not Metered	Not Metered	N/A
2033	Measurements & Controls Facility	31,287	Not Metered	N/A	N/A	Not Metered	N/A
2500	Fire Department Headquarters	10,912	Not Metered	N/A	Not Metered	Not Metered	N/A

Property ID	Property Name	Gross Square Feet	Electricity	Natural Gas	Steam or Hot Water	Potable Water	Chilled Water
2518	Support Services Building	13,399	Advanced	N/A	Not Metered	Not Metered	N/A
2523	Decontamination Laundry	7,150	N/A	N/A	N/A	Not Metered	N/A
2525	Fabrication Department Shop A	27,149	Advanced	N/A	Advanced	Not Metered	N/A
2531	Radioactive Waste Evaporator	9,004	De Minimus Use	N/A	Not Metered	N/A	N/A
2547	General Machine Shop	9,369	Advanced	N/A	Not Metered	Not Metered	N/A
2621	Electrical Utilities Shop	5,385	Advanced	N/A	Not Metered	Not Metered	N/A
2660	Office Building	6,594	Not Metered	N/A	N/A	Not Metered	N/A
2661	ORNL Regional Science Education Center	6,995	Advanced	N/A	N/A	Not Metered	N/A
3001	Graphite Reactor Building (Incl Canal)	31,138	Not Metered	N/A	Not Metered	Not Metered	N/A
3003	Solid State Accelerator Facility	12,104	N/A	N/A	Not Metered	Not Metered	N/A
3005	Low-Intensity Test Reactor Facility	5,618	Not Metered	N/A	Not Metered	Not Metered	N/A
3010	Bulk Shielding Reactor	6,024	Standard	N/A	Not Metered	Not Metered	N/A
3017	Quality Services Division Building	10,400	Standard	N/A	Not Metered	Not Metered	N/A
3019A	Radiochemical Development Facility	58,549	Standard	N/A	Not Metered	Not Metered	N/A
3025E	IMET Hot Cell Facility	18,322	Not Metered	N/A	Not Metered	Not Metered	N/A
3025M	Solid State Office & Laboratory Building	33,841	Standard	N/A	Not Metered	Not Metered	N/A
3028	Radioisotope Production Lab-A	12,000	Not Metered	N/A	Not Metered	Not Metered	N/A
3037	Chemical Technology Offices	7,680	Not Metered	N/A	N/A	Not Metered	N/A
3038	Radioisotope Laboratory	7,773	Not Metered	N/A	N/A	Not Metered	N/A
3042	Oak Ridge Research Reactor (ORRR)	39,308	Not Metered	N/A	N/A	Not Metered	N/A
3047	Isotope Technology Building	24,215	Advanced	N/A	Not Metered	Not Metered	N/A
3104	West Complex Maintenance Shop	7,411	Not Metered	N/A	Not Metered	Not Metered	N/A
3130	Waste Operations Control Center	6,169	Standard	Not Metered	Not Metered	Not Metered	N/A
3137	Surface Science Lab	6,805	Advanced	N/A	N/A	Not Metered	N/A
3144	Buildings and Power Technologies Lab.	11,482	Advanced	Advanced	Advanced	Not Metered	N/A
3147	Buildings and Power Technologies Offices	13,388	Advanced	N/A	N/A	Not Metered	N/A
3150	Solid State Research Facility	11,929	Advanced	Not Metered	Advanced	Not Metered	N/A
3156	Commercial & Residential Bldgs. Offices	6,989	Advanced	N/A	N/A	Not Metered	N/A
3500	Instrumentation Research Facility	71,154	Advanced	N/A	Not Metered	Not Metered	Not Metered
3502	East Research Service Center	12,340	Not Metered	Not Metered	Not Metered	Not Metered	N/A
3517	Fission Products Development Laboratory	17,028	Not Metered	Not Metered	Not Metered	Not Metered	N/A
3525	High-Rad Level Examination Laboratory	26,332	Advanced	Not Metered	Not Metered	Not Metered	N/A

Property ID	Property Name	Gross Square Feet	Electricity	Natural Gas	Steam or Hot Water	Potable Water	Chilled Water
3606	Instrumentation Development Facility	7,844	Not Metered	N/A	N/A	Not Metered	N/A
3608	NonRadiological Wastewater Treatment Plt	19,600	Not Metered	N/A	N/A	Not Metered	N/A
3625	Advance Microscopy Laboratory	13,012	Advanced	N/A	N/A	Not Metered	N/A
4007	Audit and Oversight Office Building	6,995	Advanced	N/A	N/A	Not Metered	N/A
4020	Maximum Energy Efficiency Research Lab	19,709	Advanced	Not Metered	N/A	Not Metered	N/A
4100	Chemical and Materials Sciences Building	155,712	Advanced	N/A	Advanced	Advanced	Advanced
4500N	Central Research & Administration North	363,980	Advanced	Not Metered	Not Metered	Advanced	Not Metered
4500S	Central Research & Administration South	317,258	Advanced	Not Metered	Not Metered	Advanced	Not Metered
4501	Radiochemistry Laboratory	75,738	Advanced	Not Metered	Not Metered	Not Metered	Not Metered
4505	Experimental Engineering	41,469	Advanced	Not Metered	Not Metered	Not Metered	Not Metered
4508	M&C Laboratory	96,972	Advanced	Not Metered	Not Metered	Advanced	Not Metered
4512	Laboratory Emergency Response Center	5,354	Not Metered	Not Metered	Not Metered	Not Metered	N/A
4515	High Temp. Materials Lab	65,093	Advanced	N/A	Not Metered	Not Metered	Not Metered
5002	Guest Users Facility	7,056	Advanced	N/A	N/A	Not Metered	N/A
5200	ORNL Conference Center	53,943	Advanced	Not Metered	Advanced	Advanced	Advanced
5500	High Voltage Accel Lab	56,857	Advanced	N/A	Not Metered	Not Metered	Advanced
5500A	South Office Building	7,005	De Minimus Use	N/A	Not Metered	Not Metered	N/A
5505	Transuranium Research Lab	23,191	Advanced	Not Metered	Not Metered	Not Metered	Not Metered
5510	Isotope Development Laboratory	6,195	Advanced	N/A	Not Metered	Not Metered	Not Metered
5510A	QSD Metrology & Intercompison Study Labs	7,360	Advanced	N/A	Not Metered	Not Metered	Not Metered
6000	ORNL Tandem Accelerator Facility	108,393	Standard	N/A	Not Metered	Advanced	N/A
6000B	Atomic Physics Research Lab	7,753	Not Metered	N/A	N/A	Advanced	N/A
6010	ORELA	59,750	Standard	N/A	Not Metered	Not Metered	Not Metered
6011	C&TD Office Building	18,583	Advanced	N/A	N/A	Advanced	N/A
6012	Computer Science Research Fac.	12,569	Advanced	N/A	N/A	Advanced	N/A
6025	Engineering Physics Office Building	17,382	Standard	N/A	N/A	Not Metered	N/A
7003	Welding & Brazing Shop	5,024	Advanced	N/A	N/A	Not Metered	N/A
7009	Carpenter Shop	9,632	Advanced	N/A	N/A	Not Metered	N/A
7012	Central Mechanical Shops	30,079	Advanced	N/A	N/A	Not Metered	N/A
7013	Acid Chem & Flam Liq Stg	7,291	Not Metered	N/A	N/A	Not Metered	N/A
7033	Electrical Material Storage	5,690	Not Metered	N/A	N/A	Not Metered	N/A
7039	Storage for LLW Line Item	10,450	Not Metered	N/A	N/A	Not Metered	N/A

Property ID	Property Name	Gross Square Feet	Electricity	Natural Gas	Steam or Hot Water	Potable Water	Chilled Water
7041	Cold Storage Building	8,000	Not Metered	N/A	N/A	Not Metered	N/A
7042	Core Storage Facility	6,040	Not Metered	N/A	N/A	Not Metered	N/A
7070	Storage Shed	6,919	N/A	N/A	N/A	Not Metered	N/A
7500	Nuclear Safety Pilot Plant	14,685	Not Metered	N/A	N/A	Not Metered	N/A
7503	MSRE Building	38,096	Not Metered	Not Metered	Not Metered	Not Metered	N/A
7506	LGWOP Maintenance Support Shop	7,209	Not Metered	Not Metered	Not Metered	Not Metered	N/A
7572	CH-TRU Waste Storage Facility	7,000	Not Metered	N/A	N/A	Not Metered	N/A
7582	LGWOD Spare Parts Storage Facility	6,410	Not Metered	N/A	N/A	Not Metered	N/A
7601	Energy Systems Office Building	25,896	Not Metered	N/A	Not Metered	Not Metered	N/A
7602	Integrated Process Demonstration Facilit	10,240	Not Metered	N/A	Not Metered	Not Metered	N/A
7603	Energy Systems Laboratory Facility	50,057	Advanced	N/A	Not Metered	Not Metered	N/A
7605	Storage Building	12,141	Advanced	N/A	N/A	Not Metered	N/A
7606A	Property Management Office	7,388	Advanced	N/A	N/A	Not Metered	N/A
7606B	General Maintenance Shop	6,374	Advanced	N/A	N/A	Not Metered	N/A
7625	MultiProgram High Bay Facility	30,183	Not Metered	N/A	N/A	Not Metered	N/A
7627	Power Supply Facility	9,273	Not Metered	N/A	N/A	N/A	N/A
7702	Control House, Tower Shielding Facility	7,841	Not Metered	N/A	N/A	Not Metered	N/A
7704	Control House-Tsf	5,200	Not Metered	N/A	N/A	Not Metered	N/A
7710	Dosimetry Applications Research Facility	9,356	Standard	N/A	N/A	Not Metered	N/A
7824	Radioactive Waste Storage	7,752	Not Metered	N/A	N/A	Not Metered	N/A
7879	TRU Solid LLW Storage Facility	6,550	Not Metered	N/A	N/A	Not Metered	N/A
7880B	Personnel Building	6,512	Standard	N/A	N/A	Not Metered	N/A
7880BB	Contact Handled Marshaling Bldg (CHMB)	7,061	Not Metered	N/A	N/A	Not Metered	N/A
7880QQ	Multi-Purpose Building (MPB)	13,150	Not Metered	N/A	N/A	N/A	N/A
7900	Hi Flux Isotope Reactor Facility	64,437	Standard	N/A	Not Metered	Not Metered	N/A
7910	Office Building For 7900	13,988	Not Metered	N/A	N/A	Not Metered	N/A
7917	Research Reactors Office Bldg.	14,963	Standard	N/A	N/A	Not Metered	N/A
7918	REDC Office & Training Facility	6,992	Standard	N/A	N/A	Not Metered	N/A
7920	Transuranic Processing Facility	33,923	Standard	Not Metered	Not Metered	Not Metered	N/A
7930	Thorium-U Recycle Facility	48,781	Standard	Not Metered	Not Metered	Not Metered	N/A
7962	Neutron Users Office	7,373	Not Metered	Not Metered	N/A	Not Metered	N/A
7964K	HFIR Modular Nine Plex Facility	8,856	Not Metered	N/A	N/A	Not Metered	N/A

Property ID	Property Name	Gross Square Feet	Electricity	Natural Gas	Steam or Hot Water	Potable Water	Chilled Water
7965D	REDC Modular Six Plex	6,016	Not Metered	N/A	N/A	Not Metered	N/A
7970	Neutron Science Support Building	5,400	Not Metered	N/A	N/A	Not Metered	N/A
7972	SANS Guide Hall	11,856	Not Metered	N/A	N/A	Not Metered	N/A
7990	Melton Valley Warehouse	9,100	Not Metered	N/A	N/A	Not Metered	N/A
7995	ORNL Melton Valley Maintenance Facility	31,002	Not Metered	N/A	N/A	Not Metered	N/A
8100	Front End Building - 8100FE	15,560	Not Metered	Not Metered	N/A	Not Metered	N/A
8200	Beam Tunnel - 8200BT	65,471	Not Metered	Not Metered	N/A	N/A	N/A
8300	Klystron Gallery - 8300KL	51,973	Not Metered	Not Metered	N/A	Not Metered	N/A
8310	Central Helium Liquifier Facility	14,166	Not Metered	Not Metered	N/A	Not Metered	N/A
8320	Superconducting Radio Frequency Building	14,408	Not Metered	Not Metered	N/A	Not Metered	N/A
8330	RF Test Facility	15,081	Not Metered	Not Metered	N/A	Not Metered	N/A
8350	Accelerator Support Office Complex	9,072	Not Metered	N/A	N/A	Not Metered	N/A
8540	Ring Service Building	18,981	Not Metered	Not Metered	N/A	Not Metered	N/A
8600	Central Laboratory and Office Building	270,915	Advanced	Advanced	N/A	Not Metered	Not Metered
8610	Center for Nanophase Materials Sciences	79,462	Advanced	Not Metered	N/A	Not Metered	Not Metered
8640	ORNL Guest House	25,934	Advanced	Not Metered	N/A	Not Metered	N/A
8700	Target Building #1	146,499	Not Metered	Not Metered	N/A	Not Metered	N/A
8702	Target Building #1 - Beam Line 2	6,503	Not Metered	Not Metered	N/A	Not Metered	N/A
8711	Target Building #1 - Beam Line 11	5,899	Not Metered	Not Metered	N/A	Not Metered	N/A
8920	Receiving Acceptance Testing Storage Bldg	25,091	Not Metered	Not Metered	N/A	Not Metered	N/A
8930	Chestnut Ridge Maintenance Shop	22,305	Advanced	N/A	N/A	Advanced	N/A
XF1303	Barn E - Deer Checking Station	7,629	Not Metered	N/A	Not Metered	Not Metered	N/A