

Energy and Transportation Science Division
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DERIVATION OF BUILDING ENERGY USE INTENSITY
TARGETS FOR ASHRAE STANDARD 100
AUGUST 31, 2011

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Date Published: June 2014

Prepared by

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managed by
UT-BATTELLE, LLC
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-00OR22725

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Derivation of Building Energy Use Intensity Targets for ASHRAE Standard 100

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August 31, 2011

The steps to develop the building energy use intensity targets for ASHRAE Standard 100 are outlined below. These analyses were conducted by Oak Ridge National Laboratory (ORNL) in collaboration with the ASHRAE Standard 100 committee and Dr. Alexander Zhivov, the subcommittee chair responsible for targets development.

Step 1: Generate Site-Energy-Based Building Total Energy Use Intensities by Building Type and Climate Zone

In this step, national building total energy use intensities (EUIs; units are kBtu/sqft-yr) are derived via analysis of the CBECS of 2003 and the RECS of 2005. The EUIs are site-energy based¹ and are national median values. The building EUI values are derived based on building types as classified by the “PBAPLUS8” variable in the CBECS database and the “TYPEHUQ” variable in the RECS database. This classification yielded over 50 different building types for the analysis (48 commercial and 5 residential). A goal of this step was to develop building EUIs by climate zone because EUIs for any given building type differ significantly depending on their climatological location.

The CBECS database, via a simple parsing method, was found inadequate to provide reliable EUI values by climate zone for a large number of commercial U.S. building types. This was primarily due to insufficient sample size when the data were parsed by building type and climate zone. A similar problem was noted by Griffin, et al. As a result, an alternative method was utilized to derive EUIs by climate zone. Zonal EUI ratios (EUI for climate zone/EUI national) were provided from building simulation modeling performed by the National Renewable Energy Laboratory (NREL; Deru, et al.) for 16 different climate zones (climate zones are shown in Figure 1).^{2,3} These ratios are shown below and were used to derive zonal EUIs by building type by multiplying them by the CBECS national median EUIs. This step produced the site-based building total EUIs by building type and climate zone shown in Table 1. A similar method was used to

¹ “Site” energy use refers to energy use measured at the building, usually by the electric, natural gas, and other energy meters.

² In the zonal EUI ratio calculation, consistent with the basis for the “EUI for climate zone” term, the “EUI national” term was also based on NREL simulation results. It is not identical to a CBECS or RECS national value.

³ The 16 different climate zones referenced in this document consists of the 8 zones shown in Figure 1 (color coded) split into the moist (A), dry (B), and marine (C) regions as delineated in the figure. Note that the small climate zone (both in geographical area and number of buildings) identifiable as Climate Zone 7B in Figure 1 was not analyzed by NREL and is not represented in this analysis. These are further described by Briggs, et al.

Ratios of climate zonal EUI to average of all zonal EUIs by building type																
ASHRAE Climate Zone:	1A	2A	2B	3A	3B-Coast	3B-Other	3C	4A	4B	4C	5A	5B	6A	6B	7	8
Building Type	Climate Zone EUI Ratio															
All Office	0.91	0.94	0.91	0.97	0.76	0.90	0.78	1.06	0.92	0.94	1.12	0.97	1.25	1.10	1.35	1.89
Large Office	0.88	0.95	0.88	0.98	0.80	0.89	0.81	1.07	0.88	0.98	1.07	0.91	1.15	1.01	1.21	1.63
Medium Office	0.98	0.97	0.98	0.97	0.78	0.93	0.77	1.05	0.91	0.93	1.11	0.96	1.24	1.09	1.33	1.86
Small Office	0.87	0.90	0.89	0.95	0.71	0.89	0.75	1.06	0.96	0.91	1.19	1.06	1.36	1.21	1.50	2.17
Warehouse	0.52	0.66	0.69	0.84	0.45	0.75	0.61	1.13	0.95	0.92	1.50	1.26	2.07	1.70	2.53	4.75
Stand-alone Retail	0.85	0.87	0.85	0.91	0.65	0.83	0.73	1.03	0.90	0.90	1.17	1.01	1.35	1.20	1.50	2.16
Strip Mall	0.89	0.89	0.87	0.94	0.69	0.86	0.77	1.08	0.94	0.96	1.24	1.06	1.43	1.27	1.60	2.29
Primary School	0.98	0.97	0.93	0.97	0.79	0.90	0.83	1.06	0.93	0.94	1.10	0.96	1.20	1.06	1.27	1.87
Secondary School	0.91	0.90	0.89	0.92	0.66	0.86	0.74	1.06	0.88	0.95	1.15	0.96	1.33	1.14	1.46	2.16
Supermarket	0.83	0.90	0.84	0.94	0.78	0.86	0.87	1.02	0.92	0.97	1.10	1.00	1.19	1.10	1.29	1.62
Fast Food	0.89	0.91	0.90	0.95	0.81	0.91	0.86	1.04	0.96	0.97	1.13	1.03	1.24	1.14	1.34	1.70
Restaurant	0.88	0.91	0.88	0.94	0.79	0.89	0.86	1.04	0.95	0.97	1.12	1.02	1.22	1.13	1.33	1.68
Hospital	1.02	1.03	1.00	1.01	0.96	0.99	0.94	1.03	0.92	0.97	1.00	0.91	1.02	0.94	1.03	1.19
Outpatient health care	1.08	1.04	1.05	1.03	0.97	1.03	0.86	1.02	0.98	0.91	0.98	0.96	1.00	0.97	0.99	1.12
Motel	1.07	1.01	1.01	0.98	0.92	0.97	0.90	1.00	0.96	0.92	1.02	0.97	1.08	1.01	1.10	1.32
Hotel	0.93	0.96	0.91	0.97	0.88	0.92	0.91	1.03	0.98	0.99	1.08	1.03	1.15	1.11	1.22	1.41
Mid-Rise Apartment	0.78	0.82	0.82	0.92	0.61	0.84	0.78	1.12	0.93	1.04	1.27	1.07	1.45	1.28	1.65	2.30

Note: The "All Office" category was calculated from the large, medium, and small office numbers.

derive the zonal EUIs for residential building types using the RECS database (also listed in Table 1).

Step 2: Identify Representative 25th Percentile Values by Climate Zone

The ASHRAE Standard 100 committee wanted to use the top (best) performing 25th percentile of an EUI distribution for each building type as the energy target for buildings. In this respect (there are considerable differences in others), this approach is similar to the criteria that EPA uses for its highly recognized Energy Star designation awarded to commercial buildings. The challenge was to identify representative 25th percentile values when there was no climate-zone EUI distribution available.

This was done by comparing the 25th percentile values from the CBECS/RECS national distributions to the distribution medians – the 50th percentile value (by building type of course). A simple ratio of the 25th to 50th percentiles was developed for each building type. These ratios were then multiplied by the climate-zone based EUIs developed in Step 1 to approximate a 25th percentile EUI value in each climate zone.

At this point, we had established high-performance energy targets by building type for each climate zone. These results are summarized in Table 2.

Step 3: Develop Schedule Multipliers

Beyond floor area, another major driver of energy use in buildings is operating hours. While perhaps a minimal concern for residential buildings (we assume 24/7 operation for residential), they are a significant energy use driver for many types of commercial buildings. As a result, ORNL conducted an analysis to investigate the impact of schedule

by building type and used that to develop a set of schedule multipliers that could be used to adjust building energy use intensities for schedule such that the comparison of a users building to Standard 100 targets could be a more reliable (i.e., a more “apple-to-apples”) comparison. An example of this need is illustrated by comparing an EUI from an office building operated for three shifts to one that is operated for only one shift. All other influences including building size being the same, the three shift building would be expected to be considerably more energy intensive that the one shift building.

Derivation of schedule multipliers began with a graphic, histogram-based inspection of the weekly operating hours of all CBECS observations by building type (the national sample). From these, three dominant weekly operating hours categories emerged. They were 1) 50 or less weekly operating hours, 2) 168 operating hours, and 3) between 50 and 168 operating hours. Based on these, median national EUIs for the CBECS observations in each of these three operational categories were calculated by building type. These were then divided by the CBECS national medians by building type (for all operational categories) to derive ratios for shift multipliers by building type. The resulting shift multipliers are summarized in Table 3.

REFERENCES

1. Briggs, Robert S., et al., “*Climate Classification for Building Energy Codes and Standards*” by the Pacific Northwest National Laboratory March 2002.
2. Deru, Michael, et al., “*U.S. Department of Energy Commercial Reference Building Models of the National Building Stock*” by the National Renewable Energy Laboratory (NREL/TP-5500-46861, February 2011) available at <http://www.nrel.gov/docs/fy11osti/46861.pdf>.
3. Griffin, B., et al., “*Methodology for Modeling Building Energy Performance Across the Commercial Sector*” by the National Renewable Energy Laboratory (NREL/TP-550-41956, March 2008) available at <http://www.nrel.gov/docs/fy08osti/41956.pdf>.
4. U.S. Department of Energy, Energy Information Administration, *Commercial Building Energy Consumption Survey (2003) and Residential Energy Consumption Survey (2005)*, <http://www.eia.doe.gov/emeu/cbeecs/> and <http://www.eia.doe.gov/emeu/recs/>.

Figure 1: ASHRAE U.S. Climate Zones

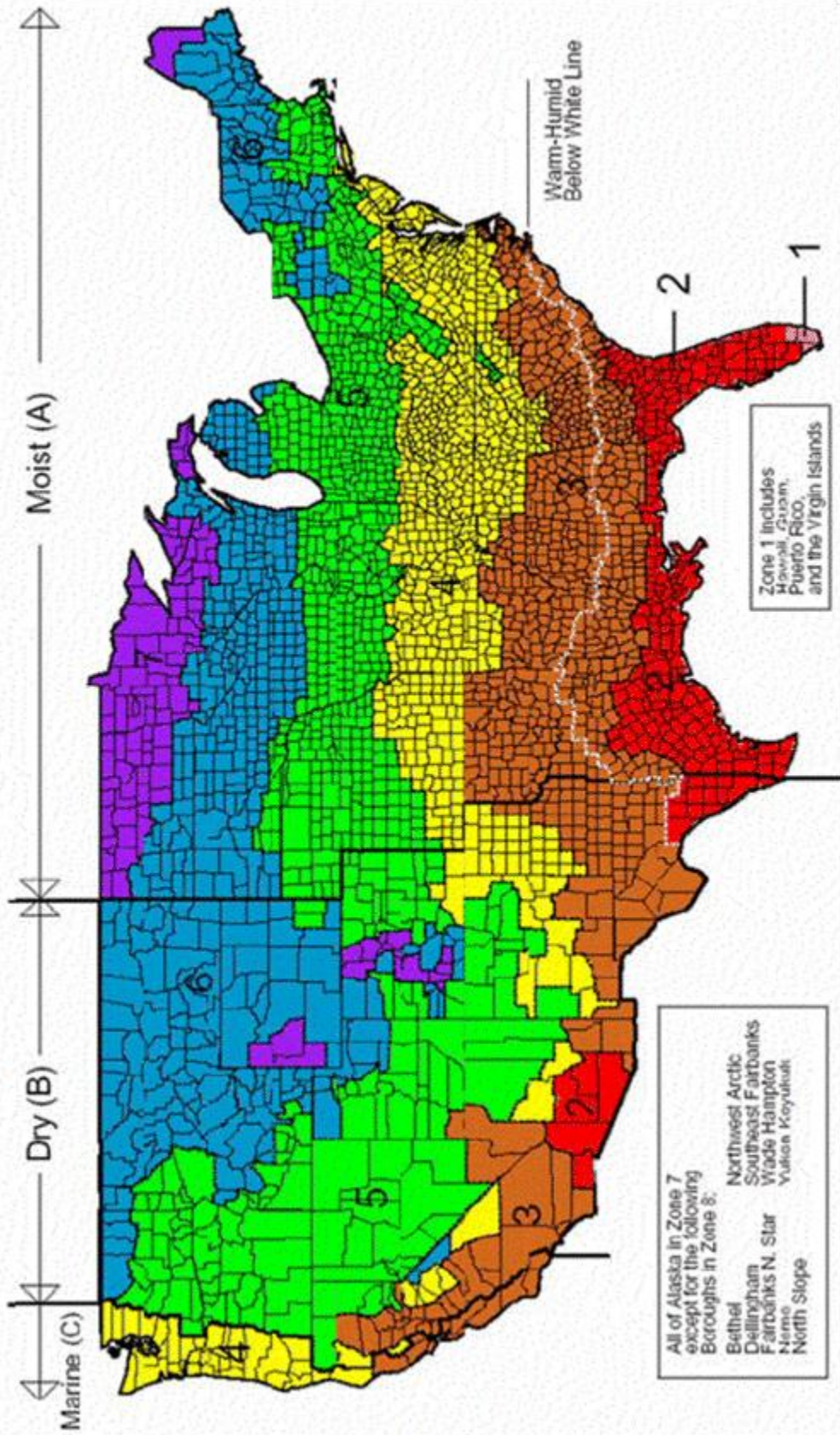


Figure 1: ASHRAE U.S. Climate Zones (cont.)		
Zone	Thermal Criteria	Representative U.S. City
1A	5000 < CDD10°C	Miami
2A	3500 < CDD10°C ≤ 5000	Houston
2B	3500 < CDD10°C ≤ 5000	Phoenix
3A	2500 < CDD10°C ≤ 3500	Atlanta
3B-Coast	2500 < CDD10°C ≤ 3500	Los Angeles
3B-Other	2500 < CDD10°C ≤ 3500	Las Vegas
3C	HDD18°C ≤ 2000	San Francisco
4A	CDD10°C ≤ 2500 AND HDD18°C ≤ 3000	Baltimore
4B	CDD10°C ≤ 2500 AND HDD18°C ≤ 3000	Albuquerque
4C	2000 < HDD18°C ≤ 3000	Seattle
5A	3000 < HDD18°C ≤ 4000	Chicago
5B	3000 < HDD18°C ≤ 4000	Denver
6A	4000 < HDD18°C ≤ 5000	Minneapolis
6B	4000 < HDD18°C ≤ 5000	Helena
7.0	5000 < HDD18°C ≤ 7000	Duluth
8.0	7000 < HDD18°C	Fairbanks
Notes:		
1. Climate zones are more fully described in the references (Briggs, et al.; Deru, et al.)		
2. Representative cities were used for simulation modeling.		

Table 1: CBECS/RECS Total Site-Based Energy Use Intensities¹

Building Category	ASHRAE Climate Zone:	1A	2A	2B	3A	3B-Coast	3B-Other	3C	4A	4B	4C	5A	5B	6A	6B	7	8
	Building Type	Total Site-Based Energy Use Intensity (site kBtu/yr-sqft)															
Education	College/university	88	88	86	89	64	83	72	103	86	92	112	93	129	111	142	210
Education	Elementary/middle school	54	53	51	53	43	50	46	58	51	52	60	53	66	58	70	103
Education	High school	64	64	63	65	47	61	53	75	63	67	81	68	94	81	103	153
Education	Other classroom education	36	36	35	36	26	34	29	42	35	38	46	38	53	45	58	86
Education	Preschool/daycare	70	68	66	69	56	64	59	75	66	66	78	68	85	75	90	133
Enclosed Mall	Enclosed mall	80	80	78	84	62	77	69	97	84	86	111	95	128	114	144	206
Food Sales	Convenience store	192	208	193	217	181	198	202	237	214	224	255	231	276	256	298	376
Food Sales	Convenience store with gas station	155	168	156	175	146	160	163	191	172	181	205	186	223	206	240	303
Food Sales	Grocery store/food market	160	174	161	181	151	165	168	197	178	187	212	192	230	213	248	313
Food Sales	Other food sales	48	53	49	55	46	50	51	60	54	57	64	58	70	64	75	95
Food Service	Fast food	374	383	375	396	339	379	361	436	400	405	474	430	519	476	561	710
Food Service	Other food service	110	113	110	117	98	111	107	129	118	122	140	127	153	141	166	209
Food Service	Restaurant/cafeteria	202	208	201	215	180	204	196	237	216	222	256	232	279	258	304	383
Inpatient Health Care	Hospital/inpatient health	202	204	200	201	191	197	186	205	184	193	198	180	203	186	205	237
Laboratory	Laboratory	249	251	245	256	213	242	221	278	249	252	294	263	323	292	346	460
Lodging	Dormitory/fraternity/sorority	57	61	60	68	45	62	57	83	69	77	94	79	107	95	122	170
Lodging	Hotel	71	72	69	74	67	70	69	78	74	75	82	78	87	84	92	107
Lodging	Motel or inn	79	75	75	73	68	72	66	74	71	68	75	72	80	75	82	98
Lodging	Other lodging	76	72	71	70	65	69	63	70	68	65	72	69	76	71	78	94
Nursing	Nursing home/assisted living	117	119	116	121	100	114	104	131	117	119	139	124	152	138	163	217
Office	Administrative/professional office	56	57	56	59	47	55	48	65	56	58	69	60	77	67	83	116
Office	Bank/other financial	79	81	80	84	66	79	68	92	80	82	98	85	109	96	117	164
Office	Government office	69	72	70	74	58	69	59	81	70	72	86	74	95	84	103	144
Office	Medical office (non-diagnostic)	47	49	48	51	40	47	41	55	48	49	59	51	65	57	70	99
Office	Mixed-use office	64	66	65	69	54	64	55	75	65	67	80	69	88	78	96	134
Office	Other office	54	55	54	57	45	53	46	63	55	56	66	58	74	65	80	112
Outpatient Health Care	Clinic/other outpatient health	72	69	70	69	64	69	57	68	65	60	65	64	67	65	66	75
Outpatient Health Care	Medical office (diagnostic)	48	46	46	46	43	46	38	45	43	40	43	42	44	43	44	50
Public Assembly	Entertainment/culture	32	33	32	33	28	32	29	36	32	33	38	34	42	38	45	60
Public Assembly	Library	85	86	84	88	73	83	76	95	86	87	101	90	111	101	119	158
Public Assembly	Other public assembly	39	40	39	41	34	38	35	44	39	40	47	42	51	46	55	73
Public Assembly	Recreation	37	37	36	38	32	36	33	41	37	37	44	39	48	43	51	68
Public Assembly	Social/meeting	38	39	38	40	33	37	34	43	38	39	45	41	50	45	54	71
Public Order & Safety	Fire station/police station	92	92	90	94	78	89	81	102	92	93	108	97	119	108	127	170
Public Order & Safety	Other public order and safety	83	84	82	86	71	81	74	93	84	85	99	88	108	98	116	154
Religious Worship	Religious worship	33	33	32	34	28	32	29	36	33	33	39	35	42	38	45	60
Retail (except malls)	Other retail	70	71	70	75	53	68	60	85	74	74	96	83	111	98	123	177
Retail (except malls)	Retail store	40	41	40	43	31	39	35	49	42	42	55	48	64	56	71	102
Retail (except malls)	Vehicle dealership/showroom	70	72	70	75	54	68	60	85	74	74	97	83	111	99	124	178
Service	Other service	84	85	83	87	72	82	75	94	84	85	100	89	109	99	117	156
Service	Post office/postal center	60	60	59	61	51	58	53	67	60	60	70	63	77	70	83	110
Service	Repair shop	40	40	39	41	34	39	35	44	40	40	47	42	52	47	55	73
Service	Vehicle service/repair shop	46	46	45	47	39	45	41	51	46	47	54	49	60	54	64	85
Service	Vehicle storage/maintenance	20	20	20	21	17	19	18	22	20	20	24	21	26	23	28	37
Strip Shopping Mall	Strip shopping mall	84	84	82	89	65	81	73	102	88	91	117	100	135	120	151	216
Warehouse	Distribution/shipping center	18	22	24	28	15	25	21	38	32	31	51	43	70	58	86	161
Warehouse	Non-refrigerated warehouse	8	11	11	14	7	12	10	19	16	15	25	21	34	28	41	78
Warehouse	Refrigerated warehouse	96	97	95	99	82	94	86	108	96	98	114	102	125	113	134	178
Residential	Mobile/manufactured home	54	57	57	64	42	58	54	78	65	73	88	74	101	89	115	160
Residential	Single-family detached	40	42	42	47	31	43	40	58	48	54	65	55	75	66	85	119
Residential	Single-family attached	46	49	49	54	36	50	46	66	55	62	75	63	86	76	98	137
Residential	Apartment (in 2-4 unit building)	68	72	71	80	53	73	68	97	81	91	110	93	126	112	144	201
Residential	Apartment (in 5+ unit building)	46	49	48	54	36	50	46	66	55	62	75	63	86	76	98	136

¹ Based on U.S. DOE/EIA Commercial and Residential Energy Consumptions Surveys (CBECS 2003 and RECS 2005).

Table 2. Energy Use Intensity Targets

No.	Commercial Building Type	EUIs by Building Type by Climate Zone (kBtu/sf-yr)															
		ASHRAE Climate Zone															
		1A	2A	2B	3A	3B	3B	3C	4A	4B	4C	5A	5B	6A	6B	7	8
1	Admin/professional office	39	40	39	42	33	39	33	46	40	40	48	42	54	47	58	81
2	Bank/other financial	55	57	56	59	46	55	47	65	56	57	68	59	76	67	82	115
3	Government office	49	50	49	52	41	48	42	57	49	50	60	52	67	59	72	101
4	Medical office (non-diag)	33	34	33	35	28	33	28	39	34	34	41	36	46	40	49	69
5	Mixed-use office	45	46	45	48	38	45	39	53	46	47	56	48	62	55	67	94
6	Other office	38	39	38	40	32	37	32	44	38	39	47	40	52	46	56	78
7	Laboratory	178	176	171	175	147	165	159	194	173	179	209	187	232	211	249	331
8	Distribution/ship center	12	16	16	20	11	18	14	27	23	22	36	30	49	40	60	113
9	Non-refrig warehouse	6	8	8	10	5	9	7	13	11	11	17	14	24	19	29	54
10	Convenience store	135	146	135	152	127	139	141	166	150	157	178	162	193	179	208	263
11	Convenience store+gas	108	118	109	122	102	112	114	133	121	126	144	130	156	144	168	212
12	Grocery/food market	112	122	113	127	106	116	118	138	125	131	149	135	161	149	174	219
13	Other food sales	34	37	34	38	32	35	36	42	38	40	45	41	49	45	53	66
14	Fire/police station	66	65	63	64	54	61	59	71	64	66	77	69	85	78	92	122
15	Other public order/safety	60	59	57	59	49	55	53	65	58	60	70	63	78	71	84	111
16	Medical office (diagnostic)	33	32	32	32	30	32	27	32	30	28	30	31	30	31	31	35
17	Clinic/other outpatient health	50	48	49	48	45	48	40	48	46	42	46	45	47	45	46	52
18	Refrigerated warehouse	69	68	66	68	57	64	62	75	67	69	81	72	90	82	96	128
19	Religious worship	23	23	22	23	19	22	21	25	23	23	27	25	30	28	33	43
20	Entertainment/culture	23	23	22	23	19	21	21	25	23	23	27	24	30	28	32	43
21	Library	61	61	59	60	50	57	55	67	60	61	72	64	80	73	86	114
22	Recreation	26	26	25	26	22	24	24	29	26	26	31	28	34	31	37	49
23	Social/meeting	28	27	26	27	23	26	25	30	27	28	32	29	36	33	39	51
24	Other public assembly	28	28	27	28	23	26	25	31	27	28	33	30	37	33	39	52
25	College/university	62	61	60	62	45	58	50	72	60	65	78	65	90	78	99	147
26	Elementary/middle school	38	37	36	37	30	35	32	41	36	36	42	37	46	41	49	72
27	High school	45	45	44	46	33	42	37	52	44	47	57	48	66	57	72	107
28	Preschool/daycare	49	48	46	48	39	45	41	52	46	47	54	47	60	53	63	93
29	Other classroom education	25	25	25	25	18	24	21	29	25	26	32	27	37	32	40	60
30	Fast food	261	268	263	277	237	266	253	305	280	284	332	301	364	333	393	497
31	Restaurant/cafeteria	141	145	141	150	126	143	137	166	151	156	179	163	195	181	213	268
32	Other food service	77	79	77	82	69	78	75	91	83	85	98	89	107	99	116	146
33	Hospital/inpatient health	142	143	140	141	134	138	130	143	129	135	139	126	142	130	144	166
34	Nursing home/assisted living	84	83	81	83	69	78	75	91	82	84	99	88	109	100	118	156
35	Dormitory/fraternity/sorority	40	43	42	47	31	43	40	58	48	54	65	55	75	66	85	119
36	Hotel	50	51	48	52	47	49	48	55	52	52	57	55	61	59	65	75
37	Motel or inn	55	53	52	51	48	50	46	52	50	48	53	50	56	52	57	69
38	Other lodging	53	50	50	49	46	48	44	49	48	46	50	48	53	50	55	66
39	Vehicle dealership/showroom	49	50	49	53	38	48	42	60	52	52	68	58	78	69	87	124
40	Retail store	28	29	28	30	21	27	24	34	30	30	39	33	45	40	50	71
41	Other retail	49	50	49	52	37	48	42	59	52	52	67	58	78	69	86	124
42	Post office/postal center	43	42	41	42	35	39	38	46	41	43	50	45	56	51	60	79
43	Repair shop	28	28	27	28	23	26	25	31	28	28	33	30	37	34	40	53
44	Vehicle service/repair shop	33	33	32	32	27	31	29	36	32	33	39	35	43	39	46	61
45	Vehicle storage/maintenance	14	14	14	14	12	13	13	16	14	14	17	15	19	17	20	27
46	Other service	60	60	58	59	50	56	54	65	59	60	71	63	78	71	84	112
47	Strip shopping mall	59	59	58	62	46	57	51	71	62	63	82	70	94	84	106	151
48	Enclosed mall	56	56	55	59	44	54	49	68	59	60	78	67	90	80	101	144
No.	Residential Building Type	ASHRAE Climate Zone															
		1A	2A	2B	3A	3B	3B	3C	4A	4B	4C	5A	5B	6A	6B	7	8
49	Mobile home	38	40	40	45	30	41	38	54	45	51	62	52	71	62	80	112
50	SF-detached	28	30	30	33	22	30	28	40	34	38	46	38	52	46	60	83
51	SF-attached	32	34	34	38	25	35	32	46	39	43	53	44	60	53	69	96
52	Apartment building (2-4 units)	47	50	50	56	37	51	47	68	57	64	77	65	89	78	101	140
53	Apartment building (5+ units)	32	34	34	38	25	35	32	46	39	43	53	44	60	53	68	96

Table 3: Operating Shift Multipliers

Operating Shift Multipliers					Operating Shift Multipliers				
No.	Building Activity/Type	Weekly Hours			No.	Building Activity/Type	Weekly Hours		
		50 or less	51 to 167	168			50 or less	51 to 167	168
1	Admin/professional office	1.0	1.0	1.4	28	Preschool/daycare	0.8	1.3	1.3
2	Bank/other financial	1.0	1.0	1.4	29	Other classroom education	0.8	1.3	1.3
3	Government office	1.0	1.0	1.4	30	Fast food	0.4	1.1	2.1
4	Medical office (non-diag)	1.0	1.0	1.4	31	Restaurant/cafeteria	0.4	1.1	2.1
5	Mixed-use office	1.0	1.0	1.4	32	Other food service	0.4	1.1	2.1
6	Other office	1.0	1.0	1.4	33	Hospital/inpatient health	1.0	1.0	1.0
7	Laboratory	1.0	1.0	1.0	34	Nursing home/assisted living	1.0	1.0	1.0
8	Distribution/ship center	0.7	1.4	2.1	35	Dormitory/fraternity/sorority	1.0	1.0	1.0
9	Non-refrig warehouse	0.7	1.4	2.1	36	Hotel	1.0	1.0	1.0
10	Convenience store	1.0	1.0	1.4	37	Motel or inn	1.0	1.0	1.0
11	Convenience store+gas	1.0	1.0	1.4	38	Other lodging	1.0	1.0	1.0
12	Grocery/food market	1.0	1.0	1.4	39	Vehicle dealership/showroom	0.8	1.2	1.8
13	Other food sales	1.0	1.0	1.4	40	Retail store	0.8	1.2	1.8
14	Fire/police station	0.8	0.8	1.1	41	Other retail	0.8	1.2	1.8
15	Other public order/safety	0.8	0.8	1.1	42	Post office/postal center	0.7	1.5	1.5
16	Medical office (diagnostic)	1.0	1.0	1.5	43	Repair shop	0.7	1.5	1.5
17	Clinic/other outpatient health	1.0	1.0	1.5	44	Vehicle service/repair shop	0.7	1.5	1.5
18	Refrigerated warehouse	1.0	1.0	1.0	45	Vehicle storage/maintenance	0.7	1.5	1.5
19	Religious worship	0.9	1.7	1.7	46	Other service	0.7	1.5	1.5
20	Entertainment/culture	0.8	1.5	1.5	47	Strip shopping mall	1.0	1.0	1.0
21	Library	0.8	1.5	1.5	48	Enclosed mall	1.0	1.0	1.0
22	Recreation	0.8	1.5	1.5	Residential Building Activity/Type				
23	Social/meeting	0.8	1.5	1.5	49	Mobile home	1.0	1.0	1.0
24	Other public assembly	0.8	1.5	1.5	50	SF-detached	1.0	1.0	1.0
25	College/university	0.8	1.3	1.3	51	SF-attached	1.0	1.0	1.0
26	Elementary/middle school	0.8	1.3	1.3	52	Apartment building (2-4 units)	1.0	1.0	1.0
27	High school	0.8	1.3	1.3	53	Apartment building (5+ units)	1.0	1.0	1.0