



**BSR/ASHRAE/IES Addendum b
to ANSI/ASHRAE/IES Standard 100-2024**

Public Review Draft

Proposed Addendum b to Standard 100-2024, Energy Efficiency in Existing Buildings

First Public Review (July, 2026)

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FOREWORD

Some background may be helpful for someone reviewing this addendum, whose purpose is to remove source energy use intensity (EUI) targets from the main body of the standard and instead present it as an option in an informative appendix of the standard.

In early 2023, the ASHRAE leadership, as part of its focus on greenhouse gas (GHG) emissions, supported expanding the scope of Std. 100 to include GHG emissions. This expansion of scope required a very substantial addendum (addendum k) to Std. 100-2018. This was developed by the Project Committee, put out for public review, and published just in time for its inclusion in Std. 100-2024

Std. 100-2024 includes EUI targets for site energy and source energy, and has added GHG Intensity (GHGI) targets. It also changed the basis for calculating site energy use. Previous to 2024, site energy use was determined on a net-energy basis, defined as all energy imported to the building minus any energy exported from the building for beneficial use (e.g. for charging electric vehicles). Any on-site renewable energy generation used to meet some of the building's energy use, was not counted. So a building that would greatly exceed its site EUI target without on-site energy, might meet its target with it. In view of this, the 2024 standard changed site energy use to a gross-energy basis, defined as all energy imported to the building plus all on-site generated energy that is used by the building minus any energy exported from the building for beneficial use. Removing source EUI as an energy compliance metric using a gross-energy basis closes a possible loophole and helps preserve the standard's goal of achieving highly efficient buildings.

In addition, the Project Committee observes that site EUI is the most common energy metric used for building performance standards in North America, and that source EUI is used only rarely as a metric. To simplify the standard, which currently allows a building to comply via site or source EUI targets, the committee decided to move all source EUI targets to an informative appendix. A jurisdiction wishing to use source EUI as a performance metric may use the new informative appendix to do so, while the main body of the standard is more directly applicable to jurisdictions currently adopting building performance standards.

This addendum will have no effect on a building that does not have EUI or GHGI targets. However, for buildings that do have targets, the Project Committee is aware that some provision needs to be made for buildings with a combined heat and power (CHP) system. A CHP system uses a fossil fuel prime mover to generate electricity on-site, and then recovers some of the prime mover's waste heat in order to put it to beneficial use in the building. But because a significant amount of the waste heat cannot be recovered, a CHP building would have great difficulty meeting a site EUI target without some accommodation.

The addendum addresses this by counting only 80% of the fossil fuel used for the CHP prime mover as a charge against the building's site energy consumption. However, when it comes to the building's GHGI target, 100% of the building's fossil fuel used must be considered.

The vast majority of this addendum is the deletion of all references to source energy throughout the existing standard.

There are some additions made in Section 4 to address the accommodation of buildings with targets that also have a CHP system. In normative Appendix C, Form C-2 is deleted, and existing Form C-3 is re-numbered as Form C-2. Also in Appendix C, a new Form C-3 has been added to document the site energy use and EUI for a building with a CHP system, and Form C-4 has been added to document the GHG emissions and GHGI for such a building.

Table 5-2 has been deleted and is replaced by a new Table 5-2 whose energy forms match those in Tables C-1 through C-4.

Finally, a considerable part of the source energy documentation that is deleted from throughout the standard has been included in a new Informative Appendix so that it will be available for reference.

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and strikethrough (for deletions) unless the instructions specifically mention some other means of indicating the changes. Only these changes are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed substantive changes.

Addendum b to Std. 100-2024

In Section 3, add the following definition:

combined heat and power: A system that generates electricity and/or mechanical power from a prime mover, with the prime mover's exhaust being recovered as thermal energy for beneficial use.

In Section 3, delete the following definition:

~~**source energy:** site energy plus the estimated energy consumed or lost in the extraction, processing, and transportation of primary energy forms such as coal, oil, natural gas, biomass, and nuclear fuel; energy consumed in conversion to other energy forms; and energy consumed or lost in transmission and distribution to the building site. See also primary energy.~~

Revise Section 4.2.1.2 (e) as follows:

4.2.1.2 The *qualified person* determining compliance shall

- Determine whether or not the *building* seeking compliance has *performance targets* according to Section 7,
- If applicable, establish the *performance targets* according to Section 7
- Complete Form B
- Indicate on Form A if this compliance is for the whole *building* or for individual tenant spaces in a multitenant *building*
- Submit Forms A, B, C-1, and C-2, ~~and C-3~~ to the *authority having jurisdiction (AHJ)*

Exception to 4.2.1.2 (e): for a *building* that has a *combined heat and power* system, submit Forms A, B, C-3 and C-4 to the *authority having jurisdiction*.

Revise Section 4.2.2.2 as follows:

4.2.2.2 The *qualified person* determining compliance shall indicate on Form A if this compliance is for the whole *building* or for individual dwellings in a multidwelling *building* and

submit Forms A, B, C-1 and C-2, ~~and C-3~~ to the AHJ.

Exception to 4.2.2.2: for a *building* that has a *combined heat and power* system, submit Forms A, B, C-3 and C-4 to the *authority having jurisdiction*.

Revise Section 4.4.1 and add Section 4.4.1.1 as follows:

4.4.1 Measured Energy Use Intensity and Greenhouse Gas Intensity. The *qualified person* shall calculate the *building's* measured *energy use intensity (EUI)* and *greenhouse gas intensity (GHGI)* by completing Forms C-1, ~~and C-2 and C-3~~ according to Section 5.2.

Exception to 4.4.1: for a *building* that has a *combined heat and power* system the *qualified person* shall follow the requirements in Section 4.4.1.1, and shall calculate the *building's* measured EUI and GHGI Forms by completing Forms C-3 and C-4 according to Section 5.2.

4.4.1.1 Measured Energy Use Intensity and Greenhouse Gas Intensity for buildings with a combined heat and power system. The *qualified person* shall calculate the *building's* measured *energy use intensity (EUI)* and *greenhouse gas intensity (GHGI)* by completing Forms C-3 and C-4 according to Section 5.2.

Informative Notes to 4.4.1.1:

Note a: In completing Form C-3, Site Energy Use Intensity Calculations:

(1) In Column A, the rows listed as “CHP1” and “CHP2” shall be used to calculate site energy used by the CHP system. Two rows are provided to accommodate a CHP system that might use two different energy forms.

(2) In Column C, enter the energy form (from column A) that is used by the CHP system, and use the information for this energy form in filling Columns E, F and G.

(3) The value in Column I equals the value in Column E times the value in Column G times the value in Column H.

(4) The value in Column H is pre-determined as reflecting good practice for CHP system efficiency, and reduces the calculated annual site energy use based on this efficiency.

Note b: In completing Form C-4, Greenhouse Gas Intensity Calculations:

(1) In Column A, the rows listed as “CHP1” and “CHP2” shall be used to calculate greenhouse gas emissions from the CHP system.

(2) In Column C, enter the energy form (from Column A) that is used by the CHP system, and use the information for this energy form in filling Column E.

(3) The value in Column G equals the value in Column D times the value in Column E times the value in Column F.

(4) The value in Column F is pre-determined, and ensures that GHG emissions from the CHP system reflect the overall energy input to the CHP system.

Revise the Informative Note to Section 4.4.2.2 as follows:

4.4.2.2 Building Meets the Performance Targets. If the *building's* measured *EUI* is less than or equal to its *EUI target*, and the *building's* measured *GHGI* is less than or equal to its *GHGI target*, then the *building* complies.

Informative Note: The AHJ has the authority to remove either the *EUI* or *GHGI* requirement above and to specify whether the *EUI target* is based on site *EUI* or source *EUI*.

Revise Section 4.4.2.4 as follows:

4.4.2.4 Verification of Compliance. Within fifteen months after the completion of Section 4.4.2.3, the *EUI* and *GHGI* shall be recalculated by the *energy manager* from 12 consecutive months of measured energy use, and ~~Form Forms A, C-1 and C-2, (Forms A, C-3 and C-4 for buildings with a CHP system)~~ shall be resubmitted to the AHJ. If the *building's* postimplementation *EUI* is less than or equal to the *EUI target*, and the *building's* postimplementation *GHGI* is less than or equal to the *GHGI target*, the *building* complies with the standard. If the *building's* postimplementation measured *EUI* is greater than the *EUI target*, or the *building's* postimplementation measured *GHGI* is greater than the *GHGI target*, the *building* does not comply with the standard and the *conditional compliance* is sus-

pending until either

- a. Additional *EEMs* and *ERMs* have been implemented that reduce the subsequently measured *EUI* and *GHGI* to less than or equal to the *EUI target* and *GHGI target*, respectively, and a new Form ~~Forms~~ A, C-1 and C-2, (~~Forms A, C-3 and C-4 for buildings with a CHP system~~) are is submitted to the *AHJ* or
- b. The *AHJ* revokes *conditional compliance*

Revise Section 4.5.2 as follows:

4.5.2 Alternative Energy Use Intensity Targets. The *qualified person* determining compliance shall demonstrate to the *AHJ* that they have met the required site *EUI targets* ~~on either a *site energy* or *source energy* basis~~ in accordance with Section 7 or Section 10 or have met the requirements in Section 4.4.3 for *buildings* without *EUI targets*. Alternative *performance* requirements, such as those in Normative Appendix B, are permitted to be specified by the *AHJ*.

Revise Section 5.2.1 as follows:

5.2.1 Provide measured *gross energy* consumption data for each *building*, including all forms of imported energy, ~~exported energy~~ exported for beneficial use, and energy generated from active on-site renewable energy systems from at least 12 consecutive months of data monitored in a period not to exceed two years prior to the date an application for compliance is submitted to the *authority having jurisdiction (AHJ)*. The *gross energy* concept is illustrated in Figure 5-1 and is calculated in accordance with Section 5.2.4. A *building's gross energy* use shall be calculated using Equation 5-1:

$$\begin{aligned} & \text{Gross energy use} = \\ & \text{Energy delivered to the } \textit{building} + \text{On-site renewable energy produced and delivered to the } \textit{building} - \\ & \text{Excess energy exported from } \textit{building} \text{ for beneficial use} \end{aligned} \quad (5-1)$$

Informative Notes:

1. As shown in Figure 5-1, a *building's gross energy* use is the sum of on-site *building* renewable energy production provided to the *building* (if any) plus purchased energy delivered to the *building* minus any excess energy exported from *building* for beneficial use.
2. Examples of excess energy exported from *building* for beneficial use are as follows:
 - a. Energy used for recharging battery-powered electric vehicles
 - b. Energy directed to another *building* on the same plot of land or campus that will be accounted as metered energy delivered to that *building*

Revise Section 5.2.3, including Informative Note, as follows:

5.2.3 Site Energy, ~~Source Energy~~, and Greenhouse Gas Emissions Calculation. *Gross energy* shall be converted to *site energy*, ~~*source energy*~~, and *GHG emissions* according to Sections 5.2.3.1 ~~through and~~ 5.2.3.2 ~~3~~.

Informative Note: Forms C-1 and C-2, ~~and (Forms C-3 and C-4 for buildings with CHP systems)~~ can shall be used to calculate *site energy*, ~~*source energy*~~, *GHG emissions*, *site EUI*, ~~*source EUI*~~, and *GHGI*.

Delete Section 5.2.3.2 in its entirety.

~~**5.2.3.2 Source Energy Conversion Factors.** *Source energy* shall be calculated using Equation 5-3:~~

~~$$\text{Source energy} = \text{Site energy}_1 \times \text{SEF}_1 + \dots + \text{Site energy}_i \times \text{SEF}_i + \dots + \text{Site energy}_n \times \text{SEF}_n \quad (5-3)$$~~

~~where~~

~~Site energy_i = site energy associated with energy form i , where i equals 1 to n~~

~~SEF_i = source energy conversion factor associated with energy form i , where i equals 1 to n~~

~~The *AHJ* shall be permitted to~~

- Substitute the national electricity *source energy* conversion factor in Table 5-2 with the appropriate regional factor in Table 5-3 applicable to the *building* location
- Substitute other *source energy* conversion factors for electricity and other energy forms following the processes and procedures incorporated within ANSI/ASHRAE Standard 105-2
- Substitute other locally appropriate *source energy* conversion factors

Delete existing Table 5-2, and replace it with a new Table 5-2

Table 5-2 U.S. Source Energy and Greenhouse Gas Emissions Conversion Factors

Energy Form		Source Energy Conversion Factor	Greenhouse Gas Emissions Factor, GWP ₁₀₀ (lb CO ₂ e/kBtu)	Greenhouse Gas Emissions Factor, GWP ₁₀₀ (kg CO ₂ e/MJ)
Grid electricity		2.74	0.326	0.140
Grid natural gas		1.09	0.147	0.063
Grid fuel oil		1.19	0.196	0.084
Grid liquefied petroleum gas (LPG) or propane		1.15	0.169	0.073
Coal		1.10	0.242	0.104
Other		Note a	Note a	Note a
Purchased district energy	Hot water	1.35	0.234	0.101
	Steam	1.45	0.247	0.106
	Chilled Water	1.04	0.083	0.036
On-site renewable thermal energy production		Note b	Note b	Note b
On-site renewable electricity production		Note b	Note b	Note b

Notes:

a. To be approved by the *AHJ*. Default values are 1.10 for *source energy* conversion factor and 0.242 lb CO₂e/kBtu (I-P) or 0.104 kg CO₂e/MJ (SI) for *GHG emissions* factor.

b. To be approved by the *AHJ*. Default values for qualified renewables are 1.00 for *source energy* conversion factor and 0.000 lb CO₂e/kBtu (I-P) or 0.000 kg CO₂e/MJ (SI) for *GHG emissions* factor.

Informative Note: Energy accounting and conversion factors shown in Table 5-1 are based on *site energy*. For further information about these approaches, please see Appendix J and Appendix K of ANSI/ASHRAE Standard 105. The *AHJ* may use the 20-year GWP time horizon (GWP20) or the 100-year GWP time horizon (GWP100) for *GHG emissions* factors. Refer to ANSI/ASHRAE Standard 105, Section J2.2 for further information on GWP20 approaches. To reference a full set of *GHG emissions* factors for the United States using 20-year GWP time horizon, refer to ANSI/ASHRAE Standard 228, Informative Appendix E or ANSI/ASHRAE/ICC/USGBC/IES Standard 189.1-2023, Section 7.6.

Table 5-2 U.S. Source Energy and Greenhouse Gas (GHG) Emissions Conversion Factors

<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
	Energy Form (The energy forms below match the lists of energy forms in Tables C-1, C-2 and C-3)	GHG Emissions Factor, GWP ₁₀₀ (lb CO ₂ e/kBtu)	GHG Emissions Factor, GWP ₁₀₀ (kg CO ₂ e/MJ)
<u>1a</u>	<u>Grid electricity</u>	<u>0.326</u>	<u>0.140</u>
<u>1b</u>	<u>Lower carbon electricity</u>	<u>Note b</u>	<u>Note b</u>
<u>1c</u>	<u>Zero-carbon electricity^b</u>	<u>0.00</u>	<u>0.00</u>
<u>2a</u>	<u>Grid natural gas</u>	<u>0.147</u>	<u>0.063</u>
<u>2b</u>	<u>Lower carbon natural gas</u>	<u>Note b</u>	<u>Note b</u>
<u>3</u>	<u>Purchased district energy – Steam</u>	<u>0.247</u>	<u>0.106</u>
<u>4</u>	<u>Purchased district energy – Hot water</u>	<u>0.234</u>	<u>0.101</u>
<u>5</u>	<u>Purchased district energy – Chilled water</u>	<u>0.083</u>	<u>0.036</u>
<u>6a</u>	<u>Grid fuel oil^a</u>	<u>0.196</u>	<u>0.084</u>
<u>6b</u>	<u>Lower carbon fuel oil</u>	<u>Note b</u>	<u>Note b</u>
<u>7a</u>	<u>Grid propane or LPG</u>	<u>0.169</u>	<u>0.073</u>
<u>7b</u>	<u>Lower carbon propane or LPG</u>	<u>Note b</u>	<u>Note b</u>

8	Coal	0.242	0.104
9	Biofuels	Note b	Note b
10	Transportation vehicle energy ^{c,d}	0.00	0.00
11	On-site renewable thermal energy production ^d	0.00	0.00
12	On-site renewable electricity production ^d	0.00	0.00
13	Other on-site energy production	Note b	Note b

Notes:

- a. Conversion factors are for #2 fuel oil. For other grades of fuel oil, obtain conversion factors from Table 5-1
- b. Documentation of lower carbon or zero-carbon energy forms shall include: (1) ownership source of the energy form purchase, and (2) the GHG emissions factors, shall be submitted to, and approved by, the AHJ. GHG factors for lower-carbon fuels shall be calculated in accordance with the carbon intensity methodology in the California Air Resources Board Low Carbon Fuel Standard, not inclusive of credits for avoided emissions, or with the net greenhouse gas emission methodology in the U.S. Environmental Protection Agency Renewable Fuel Standard. For locations outside the United States, GHG factors for lower carbon fuels shall be calculated in accordance with a methodology acceptable to the adopting authority. If any aspect of the energy form changes, the building owner shall obtain updated data and submit it to the AHJ. If any conversion factor changes such that the building no longer meets its performance targets, the building shall begin a new compliance process using the updated conversion factor(s). For procurement, the purchase contract shall have a duration of not less than 15 years, or until the next compliance cycle, whichever is shorter.
- c. Factors apply to both imported electricity and/or electricity exported for beneficial use. For other energy forms use the appropriate factors.
- d. Factors to be approved by the AHJ.

Delete Table 5-3 in its entirety.

Table 5-3 U.S. Regional Electricity Source Energy Conversion Factors

eGrid 2018 Sub-region Acronym	eGrid 2018 Sub-region Name	Source Energy Conversion Factor—Captured Energy Efficiency Approach	Source Energy Conversion Factor—Infinite Energy Efficiency Approach
AKGD	ASCC Alaska Grid	2.66	2.46
AKMS	ASCC Miscellaneous	1.91	1.21
ERCT	ERCOT All	2.51	2.31
ERCC	ERCC All	2.77	2.62
HIMS	HICC Miscellaneous	2.90	2.51
HIOA	HICC Oahu	3.51	3.06
MROE	MRO East	3.07	2.88
MROW	MRO West	2.69	2.35
NYLI	NPCC Long Island	3.36	2.79
NEWE	NPCC New England	2.77	2.26
NYCW	NPCC NYC/Westchester	2.94	2.88
NYUP	NPCC Upstate NY	2.23	1.72
RFCE	RFC East	2.95	2.83
RFCM	RFC Michigan	2.97	2.82
RFCW	RFC West	3.08	3.01
SRMW	SERC Midwest	3.14	3.08
SRMV	SERC Mississippi Valley	2.78	2.71
SRSO	SERC South	2.86	2.72
SRTV	SERC Tennessee Valley	2.94	2.81
SRVC	SERC Virginia/Carolina	2.99	2.81
SPNO	SPP North	2.67	2.37
SPSO	SPP South	2.61	2.31
CAMX	WECC California	2.07	1.55
NWPP	WECC Northwest	1.93	1.28
RMPA	WECC Rockies	2.59	2.27
AZNM	WECC Southwest	2.87	2.71

Informative Note: Energy accounting and conversion factors shown in Tables 5-2 and 5-3 are based on *site energy* using conversion factors in Table 5-1 converted to *source energy* for buildings in the United States. Section 4.5.2 of this standard allows alternative *EUI targets* established by the adopting *AHJ*. The *AHJ* may use the captured energy efficiency approach or the infinite energy efficiency approach for regional conversion factors. The *AHJ* may use the 20-year GWP time horizon (GWP20) or the 100-year GWP time horizon (GWP100) for *GHG emissions* factors. For further information about these approaches, please see ANSI/ASHRAE Standard 105.

Revise Section 7.1.2 as indicated.

7.1.2 Energy Use *Intensity* Targets. *EUI targets* based on *site energy* are shown in Table 7-2 in both I-P and SI units. ~~*EUI targets* based on *source energy* are shown in Table 7-3 in both I-P and SI units. *Site energy* electricity use and fossil-fuel use targets listed in Table 7-5 and 7-6, respectively, are for use in target calculations by *authorities having jurisdiction*.~~

All *EUI targets* and *greenhouse gas intensity (GHGI) targets* were derived from 2012 Commercial Building Energy Consumption Survey (CBECS)³ and 2015 Residential Energy Consumption Survey (RECS)⁴ data by Oak Ridge National Laboratory (ORNL) and the U.S. Department of Energy (DOE) and represent the 25th bottom (low energy) percentile of energy use by each *building* category.

The median numbers for each *building* category from CBECS and RECS data representing all *buildings* in the *building* type/activity across all climatic conditions were extrapolated to 20 DOE climate zones using multipliers generated through simulation of a representative *building* for each group of *building* categories. Informative Appendix G gives a detailed explanation of *EUI target* table derivation.

Delete Section 7.1.2.1 in its entirety.

~~**7.1.2.1 Source Energy Use Intensity Targets with Custom Source Energy Conversion Factors.** When an *authority having jurisdiction (AHJ)* uses a custom *source energy* conversion factor (any factors other than those in Table 5-2), it shall use Tables 7-5 and 7-6 to generate *source EUI targets* in conjunction with the *source energy* conversion factors used to calculate *source energy* in Section 5.2. Performance targets shall be calculated using Equation 7-1:~~

$$EUI_{t1} = (ELUI_{t1} \times SEF_{el}) + (FEUI_{t1} \times SEF_{fe}) \quad (7-1)$$

where

~~$ELUI_{t1}$ = electricity *EUI target* from Table 7-5~~

~~SEF_{el} = local *source energy* conversion factor for electricity use~~

~~$FEUI_{t1}$ = fossil fuel *EUI target* from Table 7-6~~

~~SEF_{fe} = local *source energy* conversion factor for fossil fuel energy use~~

~~**Informative Note:** Tables 7-5 and 7-6 should not be applied separately for individual energy sources.~~

Revise Section 7.2.2 as indicated.

7.2.2 *EUI targets* for *buildings* with a single activity shall be calculated using Equation 7-3:

$$(EUI_t) = S \times (EUI_{t1}) \quad (7-3)$$

where (EUI_{t1}) is the *building* activity *EUI target* value in Table 7-2 ~~or 7-3~~ for the appropriate *building* activity/type and climate, and S is the *building* operating shifts normalization factor in Table 7-7.

Revise Section 7.2.3 as indicated.

7.2.3 *EUI targets* for *buildings* with multiple activities shall be determined using weighted averages of *building* activity *EUI target* (EUI_t) for each area with a single activity using Equation 7-4 and shall be reported on Form B:

$$EUI_t = A_1 \times S_1 \times (EUI_{t1})_1 + \dots + A_i \times S_i \times (EUI_{t1})_i + \dots + A_n \times S_n \times (EUI_{t1})_n \quad (7-4)$$

where

A_i = percentage of the gross floor area with single building activity i

$(EUI_{t1})_i$ = *building* activity target from Table 7-2 ~~or 7-3~~ for space i

S_i = operating shifts normalization factor from Table 7-7 for space i

Delete Table 7-3a in its entirety.

Table 7-3a Building Activity Source Energy Use Intensity Targets (EUI_{int}) (I-P)

		EUIs by Building Type by Climate Zone (kBtu/ft ² -yr)																			
		ASHRAE Climate Zone																			
No.	Commercial Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
1	Admin/professional office	119	121	103	92	86	79	78	65	77	64	81	78	71	73	69	69	82	71	90	111
2	Bank/other financial	203	207	176	157	146	134	133	111	131	109	137	134	120	124	118	118	140	122	154	190
3	Government office	133	135	115	102	95	88	87	73	86	71	90	87	78	81	77	77	92	79	101	124
4	Medical office (nondiagnostic)	118	120	102	91	85	78	77	64	76	63	80	77	70	72	68	68	81	70	89	110
5	Mixed-use office	105	107	91	81	76	70	69	58	68	57	71	69	62	64	61	61	73	63	80	98
6	Other office	100	102	86	77	72	66	66	55	64	54	68	66	59	61	58	58	69	60	76	93
7	Laboratory	344	340	298	264	248	229	232	199	229	191	245	238	219	227	214	221	257	225	283	349
8	Distribution/shipping center	22	32	22	27	26	29	40	25	36	25	57	49	44	67	57	50	92	72	116	159
9	Nonrefrigerated warehouse	14	19	13	16	16	18	24	15	22	15	34	30	27	41	35	30	55	44	70	96
10	Convenience store	399	397	362	319	325	300	323	301	322	280	352	342	333	333	312	350	367	326	400	477
11	Convenience store with gas	449	447	408	360	367	339	364	340	363	315	397	385	375	375	352	395	413	368	451	538
12	Grocery store/food market	361	360	328	289	295	272	293	273	292	254	319	310	302	302	283	318	332	296	363	433
13	Other food sales	396	394	359	317	323	298	321	299	320	278	350	339	331	331	310	348	364	324	398	474
14	Fire station/police station	125	123	108	96	90	83	84	72	83	69	89	86	79	82	78	80	93	82	103	127
15	Other public order and safety	261	258	226	201	189	174	176	151	174	145	186	181	166	172	162	168	195	171	215	265
16	Medical office (diagnostic)	118	112	113	91	88	88	83	80	88	70	83	87	74	73	74	71	78	75	80	90
17	Clinic/other outpatient health	132	125	126	101	99	98	93	89	98	78	93	97	82	81	83	79	87	83	90	100
18	Refrigerated warehouse	185	183	161	142	134	123	125	107	124	103	132	129	118	122	115	119	138	121	153	188
19	Religious worship	62	61	54	48	45	41	42	36	41	34	44	43	39	41	39	40	46	41	51	63
20	Entertainment/culture	98	97	85	75	71	65	66	57	66	55	70	68	63	65	61	63	73	64	81	100
21	Library	154	152	133	118	111	102	104	89	103	85	110	107	98	102	96	99	115	101	127	156
22	Recreation	112	111	97	86	81	74	76	65	75	62	80	78	71	74	70	72	84	73	92	114
23	Social/meeting	103	102	89	79	74	68	69	60	69	57	73	71	66	68	64	66	77	67	85	105
24	Other public assembly	124	122	107	95	89	82	83	72	83	69	88	86	79	82	77	79	92	81	102	126
25	College/university	217	203	162	158	136	123	128	94	123	93	145	132	127	143	125	131	169	141	194	259

EUIs by Building Type by Climate Zone (kBtu/ft2-yr)

ASHRAE Climate Zone

28 **Table 7-3a Building Activity Source Energy Use Intensity Targets ($EUI_{t,t}$) (I-P) (Continued)**

		EUIs by Building Type by Climate Zone (kBtu/ft ² -yr)																			
		ASHRAE Climate Zone																			
No.	Residential Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
51	Mobile home	102	103	79	80	69	67	75	57	72	52	93	82	84	94	82	101	110	93	126	160
52	Single-family detached	87	87	67	68	59	56	64	48	61	44	79	70	71	80	69	74	94	79	107	136
53	Single-family attached	81	81	63	63	55	53	60	45	57	42	74	65	66	75	65	86	87	74	100	127
54	Apartment (in 2 to 4 unit building)	95	95	73	74	64	62	70	52	66	48	86	76	77	87	75	126	102	86	117	148
55	Apartment (in 5+ unit building)	75	75	58	59	51	49	55	42	53	39	69	61	62	69	60	86	81	68	93	118

Delete Table 7-3b in its entirety.

Revise Informative Note to Section 10.3.5 as indicated.

10.3.5 The *EUI* and *EUI target* shall be reported on Form A. Compliance with this standard requires that the *building* annual *gross energy* consumption be less than or equal to the intensity value for the *building* types and *building* climate zone as calculated per Section 7.2.

Exception to 10.3.5: The *AHJ* may adopt alternate *EUI targets*, such as those in Normative Appendix B, as desired.

Informative Note: Residential *EUI targets* listed in Tables 7-2, ~~7-3~~, 7-5, and 7-6 were derived from RECS 2015 data and represent the 25th bottom (low energy) percentile of energy use by each *building* category. The median numbers for each *building* category from RECS data representing all *buildings* in the *building* type across all climatic conditions were extrapolated to 20 DOE climate zones using multipliers generated through simulation of a representative *building* for each group of *building* categories. Refer to Informative Appendix G for more information.

Revise Section 10.3.6 as indicated.

10.3.6 Comparing Performance. Compare *building EUI* using the data from Form A with the *EUI targets* listed in Tables 7-2 ~~and 7-3~~ for single-use *buildings*.

Normative Appendix A – make revisions as listed below

In Form A, revise the “List actual measured EUI” line as noted.

Form A—Compliance with Standard 100

Name of Building					
Street Address					
City		State		Zip Code	
Building Owner:					
Name of qualified person:					
Street Address					
City		State		Zip Code	
Telephone No.				☐ Licensed	☐ Certified ☐ AHJ
Licensure or Certifying Authority:					
Name of energy manager (if different):					
Street Address					
City		State		Zip Code	
Telephone No.					
This compliance is for (a) whole building or (b) individual dwellings or tenant spaces. List dwelling units or tenants space names below. (Use additional sheets if necessary.)					☐ Whole building ☐ Dwelling or tenants
List the building types as defined in Table 7-1 with the percent of floor area for each:					
Use Form B and attach to this form.					
KBtu/ft ² ·yr (MJ/m ² ·yr)					
List the EUI target for this building (as calculated in Section 7.2).					
List the Actual measured EUI for this building (Form C-1 or, for combined heat and power (CHP) buildings, Form C-23).					
List the months/year of the collected data (mm/yyyy – mm/yyyy)					
Have the energy management requirements of Section 5 been met? [] Yes [] No					
Have the operation and maintenance requirements of Section 6 been met? [] Yes [] No					
Date the Level I audit was completed (N/A if none required).					

Form A—Compliance with Standard 100 (Continued)

Date the Level II audit was completed (N/A if none required).	
Have all EEMs required by Section 8 been implemented?	☐ Yes ☐ No
Have the requirements of Section 9 been completed?	☐ Yes ☐ No
We state that this building complies with ANSI/ASHRAE/IES Standard 100:	
Signature of qualified person: _____ Date: _____	
Signature of energy manager: _____ Date: _____	
Signature of authority having jurisdiction: _____	
(Conditional)(Final) Compliance _____	
_____ Date: _____	
Circle ONE	

Delete the existing Form C-2

Form C-2—Source Energy Use Intensity Calculation Table

	Energy Form ^a	Annual Site Energy (Form C-1, Column 6), kBtu/yr (MJ/yr)	Source Energy Conversion Factor ^b	Annual Source Energy, kBtu/yr (MJ/yr)
1a.	Imported grid electricity			
1b.	Imported specific renewable electricity ^c			
2a.	Imported grid natural gas			
2b.	Imported specific renewable natural gas ^c			
3.	Imported steam			
4.	Imported hot water			
5.	Imported chilled water			
6a.	Imported grid fuel oil			
6b.	Imported specific renewable fuel oil ^c			
7a.	Imported grid propane			
7b.	Imported specific renewable propane ^c			
8.	Imported coal or other ^d			
9.	Imported biofuels			
10.	On-site <i>nonrenewable</i> energy			
11.	Imported transportation vehicle energy			
12.	Exported electricity			
13.	Exported steam			
14.	Exported hot water			
15.	Exported chilled water			
16.	Exported other ^d			
17.	Exported transportation vehicle energy			
	Annual Source Energy^e (Sum of 1 to 11 minus Sum of 12 to 17), kBtu (MJ)			
	Source Energy Use Intensity (<i>gross energy</i> /gross floor area [from Form B]), kBtu/ft ² (MJ/ft ²)			
Notes: a. Grid energy forms are from the electric grid, fuel utility, or distribution system. Specific renewable energy forms are from a specific provider meeting the requirements of the adopting authority. b. See Section 5.2.3.2. c. Documentation of specific off-site renewable energy ownership or procurement shall be submitted to the adopting authority. For procurement, the purchase contract shall have a duration of not less than 15 years. d. If there is more than one "other" energy form, the entry shall be split, or additional notations made to so indicate. e. When the imported energy meter records the imported energy minus the exported energy under a net metering agreement, exported energy shall not be double counted.				

Renumber existing form Form C-3 as Form C-2

(The form itself is unchanged)

Form C-32—Greenhouse Gas Intensity Calculation

	Energy Form ^a	Annual Site Energy (Form C-1 Column 6 kBtu/yr (MJ/yr))	Greenhouse Gas Emission Factor ^b lb CO ₂ e/kBtu (kg CO ₂ e/MJ)	Annual Greenhouse Gas Emissions, lb CO ₂ e/yr (kg CO ₂ e/yr)
1a.	Imported grid electricity			
1b.	Imported specific renewable electricity ^c			
2a.	Imported grid natural gas			
2b.	Imported specific renewable natural gas ^c			
3.	Imported steam			
4.	Imported hot water			
5.	Imported chilled water			
6a.	Imported grid fuel oil			
6b.	Imported specific renewable fuel oil ^c			
7a.	Imported grid propane			
7b.	Imported specific renewal propane ^c			
8.	Imported coal or other ^d			
9.	Imported biofuels			
10.	On-site <i>nonrenewable energy</i>			
11.	Imported transportation vehicle energy			
12.	Exported electricity			
13.	Exported steam			
14.	Exported hot water			
15.	Exported chilled water			
16.	Exported other ^d			
17.	Exported transportation vehicle energy			
	Greenhouse Gas Emissions^e (Sum of 1 to 11 minus Sum of 12 to 17), lb CO ₂ e (kg CO ₂ e)			
	Greenhouse Gas Intensity (<i>greenhouse gas emissions/gross floor area</i>), lb CO ₂ e/ft ² (kg CO ₂ e/m ²)			

Notes:

a. Grid energy forms are from the electric grid, fuel utility, or distribution system. Specific renewable energy forms are from a specific provider meeting the requirements of the adopting authority.

b. See Section 5.2.3.3

c. Documentation of specific off-site renewable energy ownership or procurement shall be submitted to the adopting authority. For procurement, the purchase contract shall have a duration of not less than 15 years.

d. If there is more than one "other" energy form, the entry shall be split, or additional notations made to so indicate.

e. When the imported energy meter records the imported energy minus the exported energy under a net metering agreement, exported energy shall not be double counted.

Delete the existing Form C-3 and replace with the following

Form C-3 – Site Energy Use Intensity Calculation, for buildings with CHP System(s)

<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>	<u>I</u>
	<u>Note</u> <u>a</u>	<u>Energy Form^b</u>	<u>Source of</u> <u>Energy</u> <u>Data</u>	<u>Energy Use,</u> <u>Numerical</u> <u>Value</u>	<u>Units</u>	<u>Conversion</u> <u>Factor to</u> <u>kBtu (MJ)</u>	<u>CHP Effi-</u> <u>ciency</u> <u>Factor</u>	<u>Annual Site En-</u> <u>ergy, kBtu/vr</u> <u>(MJ/vr)</u>
CHP1		Note b					0.8	
CHP2		Note b					0.8	
1a		Imported grid electricity						
1b		Imported low-carbon electricity						
2a		Imported grid natural gas						
2b		Imported low-carbon natural gas						
3		Imported steam						
4		Imported hot water						
5		Imported chilled water						
6a		Imported grid fuel oil						
6b		Imported low-carbon fuel oil						
7a		Imported grid propane						
7b		Imported low-carbon propane						
8		Imported coal, or other						
9		Imported biofuels						
10		Imported transportation vehicle energy						
11		On-site renewable thermal energy production						
12		On-site renewable electricity production						
13		On-site other energy production						
14		Exported electricity						
15		Exported steam						
16		Exported hot water						
17		Exported chilled water						
18		Exported other						
19		Exported transportation vehicle energy						
Annual Gross Energy (From Column A - Sum of rows CHP1 to 13, minus Sum of rows 14 to 19), kBtu (MJ)								
Site Energy Use Intensity (<i>gross energy</i> / gross floor area [from Form B]), kBtu/ft ² (MJ/m ²)								
Notes:								
a. For CHP1 and/or CHP2, the imported energy form, from Column A, used by the CHP system.								
b. For CHP1 and/or CHP2, the relevant energy form descriptor from Column C.								

Add a new Form C-4

Form C-4 – Greenhouse Gas (GHG) Intensity Calculation, for buildings with CHP System(s)

<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>
	<u>Note</u> <u>a</u>	<u>Energy Form</u>	<u>Annual Site</u> <u>Energy (Form</u> <u>C-3, Col. I)</u>	<u>GHG Emission</u> <u>Factor, lb CO₂e/vr</u> <u>(kg CO₂e/MJ)</u>	<u>CHP</u> <u>Eff.</u> <u>Factor</u>	<u>Annual GHG Emis-</u> <u>sions, lb CO₂e/vr (kg</u> <u>CO₂e/vr)</u>
CHP1		Note b			1.25	
CHP2		Note b			1.25	
1a		Imported grid electricity				
1b		Imported low-carbon electricity				
2a		Imported grid natural gas				
2b		Imported low-carbon natural gas				
3		Imported steam				
4		Imported hot water				
5		Imported chilled water				
6a		Imported grid fuel oil				
6b		Imported low-carbon fuel oil				
7a		Imported grid propane				
7b		Imported low-carbon propane				
8		Imported coal, or other				
9		Imported biofuels				
10		Imported transportation vehicle energy				
11		On-site renewable thermal energy produc-				

		tion				
12		On-site renewable electricity production				
13		On-site other energy production				
14		Exported electricity				
15		Exported steam				
16		Exported hot water				
17		Exported chilled water				
18		Exported other				
19		Exported transportation vehicle energy				
Greenhouse Gas Emissions (From Column A - Sum of rows CHP1 to 13, minus Sum of rows 14 to 19), lb CO ₂ e (kg CO ₂ e)						
Greenhouse Gas Intensity (greenhouse gas emissions / gross floor area), lb CO ₂ e/ft ² (kg CO ₂ e/m ²)						
Notes: a. For CHP1 and/or CHP2, the imported energy form, from Column A, used by the CHP system. b. For CHP1 and/or CHP2, insert the relevant energy form descriptor from Column C.						

Revise Normative Appendix B title and Sections B1 and B1.1 as indicated

(This is a normative appendix and is part of this standard.)

NORMATIVE APPENDIX B

ALTERNATIVE SITE ENERGY INTENSITY TARGETS

Normative Appendix B, revise Section B1 as noted, and delete Section B1.1

B1. ALTERNATIVE SITE ENERGY USE INTENSITY AND SOURCE ENERGY USE INTENSITY TARGETS TABLES

The alternative site energy use intensity targets listed in Tables B-1 and B-2 and fuel-specific targets listed in Tables B-3 and B-4 for use in target calculations by *authorities having jurisdiction* were derived from Commercial Building Energy Consumption Survey (CBECS) 2012 and Residential Energy Consumption Survey (RECS) 2015 data by Oakridge National Lab (ORNL) and the U.S. Department of Energy (DOE) and represent the 40th bottom (low energy) percentile of energy use by each *building* category.

The median numbers for each *building* category from CBECS and RECS data representing all *buildings* in the *building* category across all climatic conditions were extrapolated to 20 DOE climate zones using multipliers generated through simulation of representative *building* for each group of *building* categories. Zone 5C values are based on U.S. *building* stock (a Canadian *building* sample was not available at the time of table development.) Refer to Informative Appendix G for further information on derivation of energy use targets.

~~B1.1 Alternative Source Energy Use Intensity Target Calculations.~~ Electricity use and fossil fuel use targets listed in Tables B-3 and B-4 shall be permitted to be used in *source energy EUI target* (EUI_{st}) calculations by *authorities having jurisdiction* in accordance with Equation A-1.

$$EUI_{st} = ELUI_{st} \times SEF_{el} + FEUI_{st} \times SEF_{fe} \quad (B-1)$$

where

$ELUI_{st}$ = local electricity *EUI target* from Table B-3

SEF_{el} = local *source energy* conversion factor for electricity

$FEUI_{st}$ = local fossil fuel *EUI target* from Table B-4

SEF_{fe} = local *source energy* conversion factor for fossil fuel energy use

Informative Note: Tables B-3 and B-4 should not be applied separately for individual energy sources. The tables are used in accordance with Equation B-1 to determine the appropriate *source energy* target.

Normative Appendix B - Delete Tables B-2a and B-2b in their entirety

Table B-2a Alternative Building Activity Source Energy Use Intensity Targets (I-P)

		EUIs by Building Type by Climate Zone (kBtu/ft ² -yr)																			
		ASHRAE Climate Zone																			
No.	Commercial Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
1	Admin/professional office	145	147	125	112	104	96	95	79	93	78	98	95	86	88	84	84	100	87	110	135
2	Bank/other financial	247	251	213	191	178	163	162	135	159	132	167	162	146	150	143	143	170	148	187	230
3	Government office	161	164	139	124	116	106	106	88	104	86	109	106	95	98	93	93	111	96	122	150
4	Medical office (nondiagnostic)	143	146	123	110	103	94	94	78	92	77	97	94	85	87	83	83	99	85	108	133
5	Mixed-use office	128	130	110	99	92	84	84	70	83	69	86	84	76	78	74	74	88	76	97	119
6	Other office	121	124	105	94	87	80	80	66	78	65	82	80	72	74	70	70	84	73	92	113
7	Laboratory	417	413	361	321	302	277	282	241	278	232	297	290	266	275	260	268	312	273	343	424
8	Distribution/shipping center	27	38	26	33	32	36	49	31	44	30	69	60	54	82	70	60	112	88	141	193
9	Nonrefrigerated warehouse	16	23	16	20	19	21	29	18	27	18	41	36	32	49	42	36	67	53	85	116
10	Convenience store	484	482	439	388	395	365	392	366	391	340	427	415	404	404	379	425	445	396	486	580
11	Convenience store with gas	545	543	495	437	445	411	442	412	441	383	481	467	456	456	427	479	502	447	548	653
12	Grocery store/food market	439	437	398	352	358	331	356	332	354	308	387	376	366	366	343	386	404	359	440	525
13	Other food sales	481	479	436	385	393	362	390	364	388	338	424	412	402	402	376	423	442	394	483	576
14	Fire station/police station	151	150	131	116	109	101	102	88	101	84	108	105	96	100	94	97	113	99	125	154
15	Other public order and safety	317	314	274	244	229	211	214	183	211	176	226	220	202	209	197	203	237	208	261	322
16	Medical office (diagnostic)	143	135	138	110	107	106	101	97	106	84	101	106	90	88	90	86	95	91	97	109
17	Clinic/other outpatient health	160	151	154	123	120	119	113	108	119	94	112	118	100	98	101	96	106	101	109	122
18	Refrigerated warehouse	225	223	195	173	163	150	152	130	150	125	160	156	143	149	140	144	168	148	185	229
19	Religious worship	75	74	65	58	54	50	51	43	50	42	54	52	48	50	47	48	56	49	62	76
20	Entertainment/culture	119	118	103	92	86	79	81	69	80	66	85	83	76	79	74	77	89	78	98	121
21	Library	187	185	162	144	135	124	126	108	125	104	133	130	119	123	116	120	139	122	154	190
22	Recreation	136	135	118	104	98	90	92	79	91	75	97	94	87	90	85	87	101	89	112	138
23	Social/meeting	125	124	108	96	90	83	84	72	83	69	89	87	80	82	78	80	93	82	103	127
24	Other public assembly	150	149	130	115	109	100	101	87	100	83	107	104	96	99	93	96	112	98	124	153
25	College/university	263	247	197	192	166	149	156	114	149	113	177	160	154	173	151	160	205	172	235	315

Table B-2a Alternative Building Activity Source Energy Use Intensity Targets (I-P) (Continued)

No.		Commercial Building Type	EUIs by Building Type by Climate Zone (kBtu/ft2-yr)																		
			ASHRAE Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7
26	Elementary/middle school	129	127	107	99	89	83	83	70	82	67	89	87	79	83	78	78	95	83	107	142
27	High school	190	178	142	139	120	108	112	82	108	82	128	116	111	125	109	115	148	124	170	228
28	Preschool/daycare	180	176	149	138	124	115	116	97	114	94	125	121	110	116	109	109	132	116	149	198
29	Other classroom education	109	107	90	84	75	70	70	59	69	57	75	73	67	70	66	66	80	70	90	120
30	Fast food	951	937	877	756	746	722	721	665	735	639	781	776	732	745	705	765	824	735	901	1079
31	Restaurant/cafeteria	682	664	611	537	520	499	508	454	514	442	557	552	527	530	500	556	582	523	635	757
32	Other food service	239	233	214	188	182	175	178	159	180	155	195	194	185	186	175	195	204	183	223	266
33	Hospital/inpatient health	603	614	561	482	492	424	441	420	430	406	438	427	411	369	350	386	385	351	395	431
34	Nursing home/assisted living	259	260	201	202	175	169	191	143	182	133	236	208	212	239	207	232	280	236	320	405
35	Dormitory/ fraternity/sorority	136	136	105	106	91	88	100	75	95	69	124	109	111	125	108	121	146	123	167	212
36	Hotel	159	151	142	121	124	111	117	113	116	103	126	124	117	119	114	123	131	118	142	166
37	Motel or inn	169	166	152	129	122	114	106	103	110	98	105	109	98	94	93	98	102	92	106	120
38	Other lodging	201	198	181	153	145	136	127	123	131	117	126	130	117	113	111	117	121	110	127	144
39	Vehicle dealership/ showroom	144	145	122	112	105	98	107	80	103	79	121	114	106	121	110	115	143	123	165	214
40	Retail store	120	120	101	93	87	81	89	66	85	66	100	94	87	100	91	95	119	102	137	177
41	Other retail	168	169	142	130	122	113	124	93	120	92	140	132	123	141	128	134	167	143	192	248
42	Post office/postal center	148	148	115	115	100	96	109	82	104	76	135	119	121	136	118	132	160	135	183	231
43	Repair shop	33	46	31	40	38	43	59	37	53	36	83	72	65	98	84	73	135	106	169	233
44	Vehicle service/repair shop	42	59	40	51	49	55	75	47	68	46	106	92	83	126	107	93	172	135	217	298
45	Vehicle storage/ maintenance	31	44	30	38	37	41	56	35	51	34	79	69	62	94	80	70	128	101	162	223
46	Other service	45	64	43	55	53	59	81	51	74	50	115	100	89	136	116	100	186	146	234	322
47	Strip shopping mall	260	263	221	204	183	172	185	139	180	141	210	197	187	212	191	202	251	215	289	373
48	Enclosed mall	157	158	133	123	110	103	111	84	108	85	127	119	112	128	115	121	151	129	174	225
49	Bar/pub/lounge	297	289	266	234	226	218	221	198	224	193	243	241	230	231	218	242	254	228	277	330
50	Courthouse/probation office	265	259	230	200	197	168	179	154	168	150	186	170	163	159	147	152	178	152	192	232

Table B-2a Alternative Building Activity Source Energy Use Intensity Targets (I-P) (Continued)

		EUIs by Building Type by Climate Zone (kBtu/ft ² -yr)																			
		ASHRAE Climate Zone																			
No.	Residential Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
51	Mobile home	124	125	96	97	84	81	92	69	87	64	113	100	102	114	99	123	134	113	153	194
52	Single-family detached	105	106	82	82	71	69	78	58	74	54	96	85	86	97	84	90	114	96	130	165
53	Single-family attached	98	99	76	77	66	64	73	54	69	50	90	79	81	91	79	105	106	90	122	154
54	Apartment (in 2 to 4 unit building)	115	115	89	89	77	75	85	64	81	59	105	92	94	106	92	153	124	104	142	179
55	Apartment (in 5+ unit building)	91	92	71	71	62	59	67	51	64	47	83	74	75	84	73	105	99	83	113	143

Table B-2b Alternative Building Activity Source Energy Use Intensity Targets (SI)

		EUIs by Building Type by Climate Zone (MJ/m ² -yr)																			
		ASHRAE Climate Zone																			
No.	Commercial Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
1	Admin/professional office	1644	1673	1419	1269	1184	1085	1077	900	1060	882	1111	1082	973	1000	953	952	1135	983	1247	1535
2	Bank/other financial	2803	2853	2420	2164	2019	1850	1837	1534	1808	1503	1894	1844	1659	1706	1624	1623	1935	1676	2126	2617
3	Government office	1829	1861	1579	1412	1317	1207	1199	1001	1179	981	1236	1203	1082	1113	1060	1059	1262	1093	1387	1707
4	Medical office (nondiagnostic)	1624	1653	1402	1254	1169	1072	1064	889	1047	871	1097	1068	961	988	941	940	1121	971	1232	1516
5	Mixed-use office	1453	1479	1255	1122	1046	959	952	795	937	779	982	956	860	884	842	841	1003	869	1102	1356
6	Other office	1379	1404	1191	1065	993	910	904	755	889	740	932	908	816	839	799	799	952	825	1046	1288
7	Laboratory	4739	4689	4104	3641	3425	3151	3198	2740	3161	2631	3376	3288	3017	3128	2950	3042	3538	3106	3899	4816
8	Distribution/shipping center	310	435	297	374	361	404	556	347	502	340	783	681	610	928	791	686	1268	997	1596	2197
9	Nonrefrigerated warehouse	187	262	179	225	217	243	334	209	302	204	471	410	367	559	476	413	763	600	961	1322
10	Convenience store	5496	5473	4988	4404	4487	4143	4457	4156	4439	3858	4851	4710	4592	4590	4302	4831	5056	4500	5518	6583
11	Convenience store with gas	6195	6169	5622	4964	5057	4670	5024	4684	5004	4348	5468	5309	5176	5174	4849	5445	5699	5072	6219	7420
12	Grocery store/food market	4982	4961	4521	3992	4067	3755	4040	3767	4024	3497	4397	4270	4162	4161	3900	4379	4583	4079	5002	5967
13	Other food sales	5461	5438	4956	4376	4458	4116	4429	4129	4411	3833	4820	4680	4562	4561	4275	4800	5024	4471	5483	6541
14	Fire station/police station	1719	1701	1489	1321	1242	1143	1160	994	1147	954	1224	1193	1094	1135	1070	1103	1283	1127	1414	1747
15	Other public order and safety	3599	3561	3117	2765	2601	2393	2429	2081	2401	1998	2564	2497	2291	2376	2240	2310	2687	2359	2961	3657

Table B-2b Alternative Building Activity Source Energy Use Intensity Targets (SI) (Continued)

		EUIs by Building Type by Climate Zone (MJ/m ² ·yr)																			
		ASHRAE Climate Zone																			
No.	Commercial Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
16	Medical office (diagnostic)	1627	1539	1563	1252	1219	1207	1151	1104	1208	959	1144	1202	1018	1002	1025	978	1074	1030	1107	1238
17	Clinic/other outpatient health	1816	1717	1744	1397	1361	1347	1285	1232	1349	1070	1277	1342	1136	1118	1144	1092	1199	1150	1235	1381
18	Refrigerated warehouse	2556	2529	2214	1964	1847	1700	1725	1478	1705	1419	1821	1774	1627	1687	1591	1641	1908	1675	2103	2598
19	Religious worship	853	844	739	656	617	567	576	493	569	474	608	592	543	563	531	548	637	559	702	867
20	Entertainment/culture	1355	1341	1173	1041	979	901	914	783	904	752	965	940	863	894	843	870	1012	888	1115	1377
21	Library	2122	2099	1837	1630	1533	1411	1432	1227	1415	1178	1511	1472	1351	1401	1321	1362	1584	1391	1746	2156
22	Recreation	1544	1528	1337	1186	1116	1027	1042	893	1030	857	1100	1071	983	1019	961	991	1153	1012	1270	1569
23	Social/meeting	1419	1404	1229	1090	1026	944	958	821	947	788	1011	985	903	937	883	911	1059	930	1168	1442
24	Other public assembly	1705	1688	1477	1311	1233	1134	1151	986	1138	947	1215	1183	1086	1126	1062	1095	1273	1118	1403	1733
25	College/university	2988	2803	2240	2178	1882	1691	1767	1294	1694	1284	2005	1822	1751	1966	1718	1812	2333	1949	2674	3578
26	Elementary/middle school	1470	1437	1217	1125	1007	938	946	790	929	764	1016	987	900	941	884	890	1078	941	1217	1612
27	High school	2159	2025	1618	1574	1359	1221	1277	935	1223	928	1448	1316	1265	1420	1241	1309	1685	1408	1931	2584
28	Preschool/daycare	2050	2003	1697	1569	1404	1308	1319	1102	1295	1065	1416	1376	1254	1312	1232	1240	1503	1312	1697	2248
29	Other classroom education	1241	1213	1027	950	850	792	798	667	784	644	857	833	759	794	746	751	910	794	1027	1361
30	Fast food	10796	10644	9960	8581	8474	8203	8190	7548	8351	7259	8875	8810	8314	8463	8011	8686	9356	8345	10237	12254
31	Restaurant/cafeteria	7743	7536	6944	6093	5901	5672	5769	5158	5833	5025	6327	6272	5990	6013	5680	6317	6607	5935	7214	8602
32	Other food service	2715	2643	2435	2137	2069	1989	2023	1809	2045	1762	2219	2199	2101	2109	1992	2215	2317	2081	2530	3016
33	Hospital/inpatient health	6848	6978	6373	5468	5590	4812	5003	4767	4879	4610	4973	4849	4664	4187	3981	4388	4376	3991	4481	4895
34	Nursing home/assisted living	2942	2951	2278	2291	1984	1914	2169	1627	2068	1507	2684	2367	2410	2710	2346	2633	3175	2675	3633	4595
35	Dormitory/ fraternity/sorority	1540	1545	1192	1199	1038	1002	1135	852	1082	789	1405	1239	1261	1418	1228	1378	1662	1400	1902	2405
36	Hotel	1804	1720	1612	1372	1403	1262	1329	1287	1316	1166	1433	1411	1332	1346	1295	1392	1486	1340	1610	1889
37	Motel or inn	1916	1885	1721	1460	1382	1290	1208	1168	1251	1109	1195	1240	1109	1072	1060	1114	1154	1043	1209	1367
38	Other lodging	2287	2249	2053	1742	1649	1539	1441	1394	1492	1323	1426	1480	1323	1279	1264	1329	1376	1245	1442	1631
39	Vehicle dealership/ showroom	1639	1648	1386	1272	1194	1108	1215	910	1168	900	1369	1291	1199	1373	1252	1307	1629	1393	1876	2425
40	Retail store	1359	1366	1149	1054	990	918	1007	755	968	746	1135	1070	994	1138	1038	1083	1350	1154	1555	2010

Table B-2b Alternative Building Activity Source Energy Use Intensity Targets (SI) (Continued)

		EUIs by Building Type by Climate Zone (MJ/m2·yr)																			
		ASHRAE Climate Zone																			
No.	Commercial Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
41	Other retail	1906	1917	1612	1480	1389	1288	1413	1059	1358	1047	1592	1502	1394	1597	1457	1520	1895	1620	2182	2821
42	Post office/postal center	1680	1686	1301	1309	1133	1093	1239	930	1181	861	1534	1352	1377	1548	1341	1504	1814	1528	2076	2625
43	Repair shop	374	525	358	451	435	487	670	418	606	409	943	821	735	1118	953	827	1528	1202	1923	2648
44	Vehicle service/repair shop	478	671	457	576	556	623	856	535	774	523	1206	1049	939	1430	1219	1058	1954	1537	2460	3386
45	Vehicle storage/maintenance	357	501	342	430	415	465	640	400	578	391	901	784	702	1068	910	790	1459	1148	1837	2528
46	Other service	515	724	494	622	600	672	924	577	835	565	1301	1132	1014	1543	1315	1141	2108	1658	2654	3653
47	Strip shopping mall	2956	2985	2514	2313	2079	1954	2101	1577	2041	1604	2389	2241	2120	2412	2172	2289	2850	2437	3284	4238
48	Enclosed mall	1778	1795	1512	1391	1251	1175	1264	949	1228	965	1437	1348	1275	1451	1307	1377	1714	1466	1976	2550
49	Bar/pub/lounge	3374	3284	3026	2655	2571	2472	2514	2248	2542	2190	2757	2733	2610	2621	2475	2753	2879	2586	3144	3748
50	Courthouse/probation office	3009	2943	2615	2268	2237	1911	2032	1746	1909	1707	2114	1931	1854	1806	1665	1730	2021	1723	2184	2630
		EUIs by Building Type by Climate Zone (MJ/m2·yr)																			
		ASHRAE Climate Zone																			
No.	Residential Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
51	Mobile home	1410	1415	1092	1098	951	918	1040	780	991	722	1287	1135	1156	1299	1125	1392	1522	1283	1742	2203
52	Single family detached	1197	1201	927	933	808	779	883	663	842	613	1093	964	981	1103	955	1022	1293	1089	1479	1871
53	Single family attached	1118	1121	865	871	754	727	824	618	786	573	1020	899	916	1030	892	1193	1206	1017	1380	1746
54	Apartment (in 2 to 4 unit building)	1304	1308	1010	1016	879	848	961	721	917	668	1190	1049	1068	1201	1040	1732	1408	1186	1611	2037
55	Apartment (in 5+ unit building)	1038	1041	804	808	700	675	765	574	730	532	947	835	850	956	828	1193	1120	944	1282	1621

Informative Appendix G - Revise the portion of Appendix G before “Step 1” as indicated.

INFORMATIVE APPENDIX G

DERIVATION OF ENERGY INTENSITY TARGETS FOR STANDARD 100

These analyses were originally conducted by Terry R. Sharp^{N14} of Oak Ridge National Laboratory (ORNL) in collaboration with the ANSI/ASHRAE/IES Standard 100 committee and Dr. Alexander Zhivov, the working group chair responsible for targets development, and are reproduced here with permission of ORNL. Much of the text of the original report has been replaced or modified by ASHRAE since its initial inclusion. Tables G-6 and G-7 illustrates example *building* energy efficiency targets in the form of total *building energy use intensities (EUIs)* (measured in kBtu/ft²·yr). Table G-6 shows the *site-energy*-based *building* total energy use efficiency targets from Table 7-2. ~~Table G-7 shows the *source-energy*-based equivalent values of Table 7-3. The different forms (site or source) have distinct advantages depending on the goal of the user or authority. Both could provide equivalent, alternate methods of complying with the efficient *building* targets of Standard 100 (if the source-based alternative were added) or serve as high performance *building* targets for other standards, codes, programs, or entities.~~

Notes:

1. *Site energy* (also called “secondary energy”) is the energy produced from raw fuel, such as electricity supplied by the grid or heat received from a district heating system (typically measured at the end use or *building*).
2. *Source energy* (also called *primary energy*) represents and accounts for the raw fuel (energy) that is consumed to create heat or generate electricity for the end user or *building* (see ASHRAE Standard 105^{N15} for additional information). This is sometimes an important consideration because as much as three units of raw fuel (energy) may be required to generate a single unit of energy for the end user or *building*, such as for electricity supplied by the grid or heat received from a district heating system.

The summary that follows provides an overview of the strategy used to derive the site ~~and source energy~~ targets in Standard 100 (Tables G-6 and G-7, respectively).

Informative Appendix G - Revise the 1st Two paragraphs of Step 1, as indicated.

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

In this step, national site *EUIs* (in kBtu/ft²·yr) were derived via analysis of the Energy Information Administration’s Commercial Buildings Energy Consumption Survey (CBECS)^{N12}. The *EUIs* derived are national median values. The *building EUI* values were derived based on *building* types as classified by the PBAPLUS8 variable in the CBECS database. This classification yielded 48 different commercial *building* types for the analysis (five additional *residential building* types are included in Standard 100). 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 (variations are typically large for site-energy-based *EUIs* and small for source-energy-based *EUIs*; compare Tables G-6 and G-7). ASHRAE climates zones are shown in Figure E-1^{N10}.

To identify representative zonal *EUIs* (CBECS observations by *building* type and climate zone were insufficient for this), zonal *EUI* ratios (*EUI* for climate zones divided by a national *EUI*) were provided from *building* simulation modeling performed by the National Renewable Energy Laboratory (NREL)^{N16} for 16 different climate zones (Figure E-1). These ratios were used to derive zonal *EUIs* by *building* type by multiplying them by CBECS national median *EUIs*. This step produced representative total site *EUIs* by *building* type and climate zone (both on a site and source basis).

Notes:

1. 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 national value.
2. The 16 different climate zones referenced in this document comprise the 8 zones shown in Figure E-1 (color coded) split into moist (A), dry (B), and marine (C) regions. The small climate zone (both in geographical area and number of *buildings*) 7B was not analyzed.

Informative Appendix G – Revise the title of Step 2.

**Step 2: Identifying Zonal Efficiency Targets—
The Top 25th Percentile Site EUI Values by Climate Zone**

Informative Appendix G – Delete Table G-7

NOTE – was not able to produce strike-through on the text in the table; table itself on the next page.

~~**Table G-7 Building Total Energy Use Targets (Source Energy)**~~

Energy Use Targets by Building Activity (EUI) (I-P Units) ¹																		
No.	Commercial Building Type	EUIs by Building Type by Climate Zone (source kBtu/ft ² -yr)																
		ASHRAE Climate Zone																
		1A	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C ²	6A	6B	7	8
1	Admin/professional office	123	127	113	130	95	112	93	109	91	118	91	90	91	101	94	109	152
2	Bank/other financial	174	180	161	185	134	159	133	155	129	167	129	128	131	143	134	154	216
3	Government office	153	158	142	162	118	140	117	136	113	147	113	113	115	126	117	136	190
4	Medical office(non-diagnostic)	105	108	97	111	81	95	80	93	77	100	77	77	77	86	80	93	130
5	Mixed-use office	142	146	131	151	110	130	108	126	105	136	105	104	105	116	109	126	176
6	Other office	119	122	110	126	91	108	90	105	87	114	88	87	89	97	91	105	147
7	Laboratory	561	555	493	548	425	477	446	463	397	522	394	404	424	436	421	468	622
8	Distribution/shipping center	39	49	48	62	31	51	40	64	52	64	67	65	56	92	80	113	212
9	Nonrefrigerated warehouse	19	24	23	30	15	25	19	31	25	31	32	31	28	45	39	55	102
10	Convenience store	424	460	391	476	367	401	396	396	343	458	337	349	391	364	357	392	494
11	Convenience store with gas	341	370	315	384	296	323	319	319	276	369	271	281	316	293	287	316	398
12	Grocery store/food market	353	383	326	397	306	334	330	330	286	382	281	291	325	303	297	326	412
13	Other food sales	107	116	99	120	93	101	100	100	87	116	85	88	98	92	90	99	125
14	Fire station/police station	207	204	182	202	156	176	164	170	146	192	145	149	157	160	155	172	229
15	Other public order and safety	188	186	166	184	142	160	150	155	133	175	132	136	143	146	141	157	209
16	Medical office (diagnostic)	105	102	94	100	87	93	75	76	70	82	57	64	66	58	60	58	66
17	Clinic/other outpatient health	158	152	141	150	130	139	112	114	105	123	86	96	98	88	90	86	98
18	Refrigerated warehouse	217	215	191	212	164	185	173	179	154	202	153	156	164	169	163	181	241
19	Religious worship	74	73	65	72	56	63	59	61	52	69	52	53	56	57	55	62	82
20	Entertainment/culture	73	72	64	71	55	62	58	60	52	68	51	53	56	57	55	61	81
21	Library	193	191	170	188	146	164	153	159	137	179	136	139	145	150	145	161	214
22	Recreation	83	82	73	81	63	71	66	69	59	77	58	60	63	65	62	69	92
23	Social/meeting	87	86	76	85	66	74	69	72	61	81	61	62	66	67	65	72	96
24	Other public assembly	89	88	78	87	67	76	71	73	63	83	62	64	68	69	67	74	99
25	College/university	194	193	175	196	130	169	142	175	141	190	154	145	156	177	160	194	288
26	Elementary/middle school	119	117	104	117	88	101	90	97	82	105	80	79	82	87	82	92	135
27	High school	142	141	127	143	95	123	103	125	100	138	108	103	110	124	113	136	201
28	Preschool/daycare	153	151	134	151	113	130	115	125	106	136	103	102	108	112	105	119	175
29	Other classroom education	79	79	71	80	53	69	58	70	56	77	60	57	63	69	63	76	113
30	Fast food	824	844	759	868	685	768	708	730	642	828	626	650	691	683	664	739	934
31	Restaurant/cafeteria	445	458	407	471	364	412	384	396	347	455	338	351	389	367	360	400	504
32	Other food service	243	250	222	258	199	225	210	216	190	248	185	192	213	201	197	219	275
33	Hospital/inpatient health	446	450	405	442	386	399	365	343	295	394	262	273	316	267	260	270	311
34	Nursing home/assisted living	265	262	233	259	200	225	210	218	187	246	186	191	199	206	199	221	294
35	Dormitory/fraternity/sorority	127	134	122	148	91	125	112	138	111	158	123	119	122	141	132	160	224
36	Hotel	156	160	140	161	135	141	135	131	119	153	108	118	124	115	117	122	141
37	Motel or inn	175	166	151	160	138	146	130	123	114	140	100	109	115	105	104	108	129
38	Other lodging	167	158	145	152	132	139	124	118	109	133	95	104	110	100	100	103	123
39	Vehicle dealership/show room	154	158	141	165	109	138	118	142	119	151	128	126	136	147	138	163	234
40	Retail store	88	90	81	94	62	79	68	82	68	87	73	72	77	84	79	93	134
41	Other retail	154	157	141	164	108	137	118	142	118	151	127	126	133	146	137	162	233
42	Post office/postal center	134	133	118	131	102	114	107	111	95	125	94	97	101	104	101	112	149
43	Repair shop	90	89	79	87	68	76	71	74	63	83	63	64	68	70	67	75	99
44	Vehicle service/repair shop	104	103	91	101	79	88	82	86	73	97	73	75	77	81	78	87	115
45	Vehicle storage/maintenance	45	45	40	44	34	38	36	37	32	42	32	32	35	35	34	38	50
46	Other service	190	188	167	185	144	161	151	157	134	176	133	137	143	147	142	158	210
47	Strip shopping mall	186	185	167	194	132	165	143	171	142	185	154	152	166	177	167	199	284
48	Enclosed mall	177	176	159	185	126	157	136	163	135	176	147	144	159	169	159	189	270
49	Mobile home	119	126	115	139	86	118	106	130	104	148	116	112	115	133	124	151	210
50	SF-detached	89	94	85	104	64	88	79	96	77	110	86	83	84	98	92	112	156
51	SF-attached	102	108	98	119	73	101	90	111	89	127	99	96	98	113	106	129	180
52	Aptmt-in 2-4 unit	150	158	144	175	107	148	133	163	131	186	146	141	143	166	156	189	264
53	Aptmt in 5+ unit	102	108	98	119	73	101	90	111	89	126	99	96	98	113	106	129	180

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

² Zone 5C values based on U.S. building stock (A Canadian building sample was not available at the time of table development.)

Note: Site to source multipliers used to create Table 2: electricity- 3.15 kBtu source/kWh site; fossil fuel- 1.09 kBtu source/kBtu site, except for College/University buildings where fossil fuel- 1.22 kBtu source/kBtu site was used (since often on district heating systems).

Informative Appendix J – Revise Item a in the 2nd paragraph of Section J1a as indicated.

J1. INTRODUCTION

This informative appendix provides guidance on how to generate *building performance targets* based on local energy benchmarking data. Jurisdictions with access to local energy benchmarking data can use it to create more locally applicable targets that can be tailored more closely to specific energy consumption or *greenhouse gas (GHG) emission* goals.

This standard provides *building performance targets* for many property types and climate *zones*. While these targets are based on a rigorous analysis of U.S. energy data (refer to Informative Appendix G), they have the following limitations:

- a. **Limited Localized Applicability.** Due to the lack of availability of regional data in the sources used to develop the targets, national target values were determined and then differentiated by climate *zone* using *building* energy modeling. This process may not be applicable to specific regions. In addition, the conversion factors used to develop the ~~source energy~~ and *GHG emission* targets are national factors that may vary significantly from local or regional factors.

Informative Appendix J – Revise the last paragraph of Section J2 as indicated.

J2. GOALS, METRICS, AND TARGETS

Jurisdictions seeking to implement ANSI/ASHRAE/IES Standard 100 are encouraged to develop their own locally relevant targets; this process assumes that a jurisdiction has the following:

- a. One or more sets of *building* energy benchmarking data, relevant to the portion of the *building* stock for which the jurisdiction plans to establish targets
- b. A policy goal for the *building* stock, such as to achieve a *GHG emissions* reduction goal of x% for each time increment, or an ultimate goal, such as zero or net-zero emissions

This informative appendix provides the following guidance:

- a. How to select metrics, which are the specific unit of measurement used to evaluate energy or emissions *performance*. The ~~three~~ two metrics used in this standard are *site energy use intensity (EUI)*, ~~source EUI~~, and *greenhouse gas intensity (GHGI)*.
- b. How to choose and verify the data used to create targets
- c. How to develop targets, which are the actual values of the metrics that *buildings* must achieve to comply with this standard (e.g., 50 kBtu/ft²/year [480 MJ/m²/year] for office *buildings*)

Informative Appendix J – Revisions throughout Section J2.2 as indicated, including in Tables J2-2, J2-3 and J2-4.

J2.2 Metric Types. Metrics are the quantifiable unit of measurement used to assess a *building's performance*. They include *site energy*, ~~source energy~~ (EPA's ENERGY STAR[®] score is another common metric based on ~~source energy~~), and *GHG emissions*. Each of these metrics has different advantages and disadvantages in terms of their complexity, treatment of different fuel sources, and treatment of off-site carbon-free electricity. ASHRAE's *Building Performance Standards: A Technical Resource Guide*^{N19} provides a comprehensive description of the different metric choices and their implications, which are summarized in Table J2-2.

Table J2-1 Comparison of Target Development with National vs. Local Datasets

Data Source Locale	Advantages	Disadvantages
--------------------	------------	---------------

National	Ease of accessibility	• Timeliness of data • Insufficient data points for specific regions and <i>building</i> types • Less accurate for local <i>buildings</i>
State or Local	Direct applicability to a region or city	• Data may not yet exist • Data may be skewed, insufficient, or need to be supplemented

Table J2-2 Comparison of Site Energy, ~~Source Energy~~, and GHG Emissions Metrics

Concept	Site Energy	Source Energy	GHG Emissions
Data complexity	• Most relatable to <i>building owners/operators/occupants</i>. • Data are accurately measurable by third parties and/or <i>building operators</i>.	• Requires conversion factors for all energy sources. • Conversion factors can be created in multiple ways to achieve different results.	• Requires conversion factors for all energy sources. • Conversion factors can be created in multiple ways to achieve different results.
Treatment of different fuel sources	Typically incentivizes electricity use over fossil fuels or district-energy systems.	Can account for upstream energy losses of different fuel sources, depending on the conversion factor development methodology.	Accounts for carbon impact of different fuel sources directly, allowing direct translation to emissions goals.
Treatment of off-site carbon-free electricity	Off-site carbon-free energy (primarily electricity but could include biogas or other fuel sources) is considered the same as any other grid energy.	Conversion factors can be selected to treat off-site carbon-free electricity as zero, lower impact, or even higher impact compared to other grid electricity.	Off-site carbon-free electricity has zero emissions.

Table J2-3 Example: Benchmarking Data Set

Building	Floor Area, ft ²	Fuel Mix	Site EUI, kBtu/ft ²	Source EUI, kBtu/ft ²	Greenhouse Gas Intensity (GHGI), lbs CO ₂ e/ft ²
DP1	131,500	60% electric/40% natural gas	35	69	9
DP2	56,300	95% electric/5% natural gas	48	123	15
DP3	153,900	45% electric/55% natural gas	61	106	14
DP4	135,500	85% electric/15% natural gas	72	173	22
DP5	60,000	100% electric/0% natural gas	83	220	27
DP6	114,600	75% electric/25% natural gas	119	267	34
DP7	90,900	40% electric/60% natural gas	250	415	55

Table J2-4 Example: % EUI or GHGI Reduction Required to Meet 25th Percentile Targets

Building	Fuel Mix	% Site EUI Reduction Required	% Source EUI Reduction Required	% GHGI Reduction Required
DP1	60% electric/40% natural gas	0%	0%	0%
DP2	95% electric/5% natural gas	0%	14%	9%
DP3	45% electric/55% natural gas	21%	0%	0%
DP4	85% electric/15% natural gas	33%	39%	36%
DP5	100% electric/0% natural gas	42%	52%	49%
DP6	75% electric/25% natural gas	60%	60%	59%
DP7	40% electric/60% natural gas	81%	74%	75%

Metrics typically include a normalization factor, the most common of which is *building* floor area. Other normalizations or categorizations include *building* type, weather/climate, number of occupants, number of beds, and operating hours. Default targets in this standard utilize ~~two three~~ metrics (*site energy*, ~~source energy~~, and *GHG emissions*) and four normalization factors (floor area, *building* type, climate, and operating hours). Choosing and developing normalization factors is discussed in more detail in Section J3.1. Other *performance* metrics are also available. ~~The ENERGY STAR[®] Score is on a 100 point scale based on source energy and many building-specific normalization factors.~~ California has developed time-dependent-value targets, which are energy- and time-dependent source factors.

Example J2.2: Seven *buildings* have the characteristics listed in Table J2-3. Setting the target at the 25th percentile of each of the ~~two three~~ metrics (*site EUI*, ~~source EUI~~, *GHGI*) results in different outcomes for many *buildings*. Figure J2-1 shows the project *EUI* or *GHGI* required for each *building* to comply with a 25th percentile target.

Note that for *site EUI*, DP1 and DP2 have the lowest *EUI*, while for ~~source EUI~~ and *GHGI*, DP1 and DP3 have the lowest metric values. This difference is due to the difference in fuel mix among the *buildings*. Additionally, each *building* has a different reduction requirement, summarized in Table J2-4.

These values will vary greatly based on the conversion factors used for ~~source energy~~ and *GHG emissions* conversions.

Informative Appendix J – Revise Section J2.3 as indicated.

J2.3 Achievement of Goals through Target Setting. *Building performance targets* can be tailored to meet specific *AHJ* reduction targets.

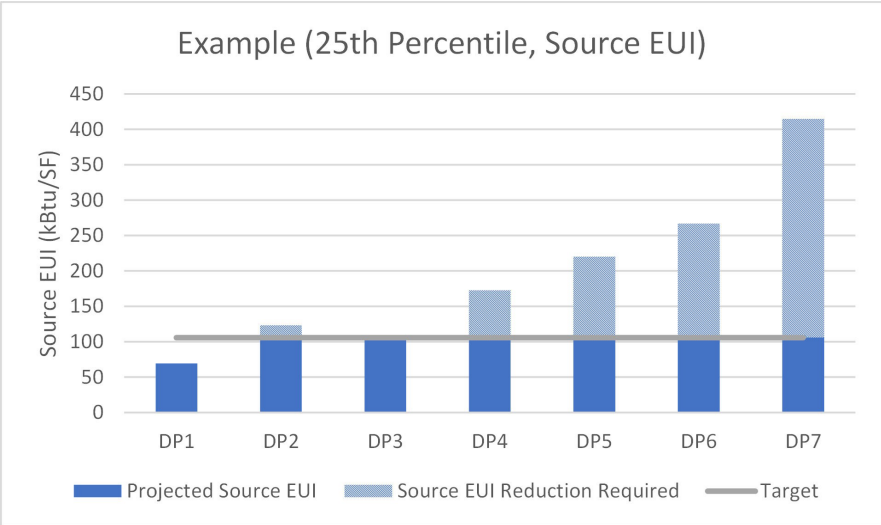
Example J2.3: An *AHJ* wishes to reduce *building site energy* use for office *buildings* and K-12 schools by 50% by 2040. It has more than 200 office *buildings* and more than 100 K-12 schools with energy benchmarking data.

Analysis of the sample data (Table J2-5, Figure J2-2) shows that if *buildings* lower their *EUIs* to median values, total office *site energy* use will drop by 33%, and total K-12 *site energy* use will drop by 10%. Further analysis shows that to achieve 50% savings in each group, the *site EUI targets* should be set at 44 kBtu/ft²/yr

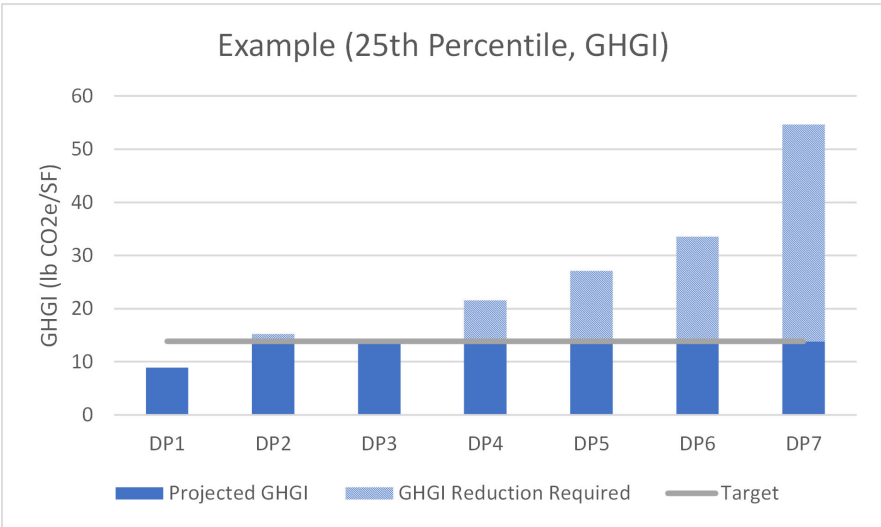
for offices and 27 kBtu/ft²/yr for K-12 schools.
These values will vary greatly based on the conversion factors used for ~~source energy~~ and GHG emissions conversions.

Informative Appendix J – Delete Table (b), below, in Figure J2.1 in Section J2.1.

NOTE – I was unable to find a way for strikethrough of the table itself.



(b)



(c)

Informative Appendix J – Revise Title of Figure J2.1 as indicated.

Figure J2-1 Example results of selecting 25th percentile targets for site EUI, ~~source EUI~~, and GHGI metrics.

Informative Appendix J – Revise Example J2.4 in Section J2.4 as indicated.

J2.4 Progression of Targets Over Time. To meet aggressive energy or emission goals, a jurisdiction may choose to set increasingly stringent requirements over time. One strategy is to set initial and final targets based on initial conditions and final goals, then to choose intermediate targets at specific intervals in between.

Example J2.4: A city has a goal of 50% *building site/source energy* use reduction by 2040. It chooses to set 2026 targets at the 75th percentile of *building energy* use such that only 25% of *buildings* need to take action for Year 1. For office *buildings*, the 75th percentile *site EUI* is 81 kBtu/ft²/yr. An analysis shows that lowering the *site EUI target* to 44 kBtu/ft²/yr will result in a 50% reduction in total office energy use (Figure J2-3).

Informative Appendix J – Delete item e in the 2nd paragraph of Section J3.2.

J3.2 Data Verification/Quality Assurance. It is important to perform a preliminary data exploration to better understand the data's characteristics and verify the data set's accuracy and consistency. A data analysis should be performed to ensure the data input for *EUIs* are accurate and reasonable. Potential data errors can be wrong energy units, incorrect area, incomplete energy data, etc.

Beyond missing data, the quality of existing data is important to accurately characterize existing *building performance*. Since benchmarking ordinances rely on self-reported data, some data may be missing or include entry errors or mistaken measurements. A jurisdiction can include collection measures and parameters to ensure higher quality data during benchmarking submission. Measures to assess data quality and to find resolutions may include the following:

- a. Identifying duplicate records
- b. Manual or automatic detection of outliers
- c. Testing assumptions and checking distributions (normal or skewed)
- d. Identifying useful raw data
- e. ~~Utilizing ENERGY STAR[®] Portfolio Manager flags on missing data fields~~
- f. Establishing flags on very high and low *EUI*, particularly on fuel sources with units that can be misinterpreted (e.g., klb of steam vs. lb of steam)

The best time for data quality control is during the benchmarking process by following up with the *buildings* that have suspect or unusual benchmarking submissions. An additional measure to improve data quality is to require periodic third-party verification of benchmarking data as part of a benchmarking ordinance.

Informative Appendix J – Revise Section J4 as indicated.

J4. ENERGY AND GREENHOUSE GAS EMISSION INTENSITY CALCULATIONS

The most common metric used in a *building performance* standard is the energy or emissions intensity of a *building*, represented as the annual energy use or energy-related emissions of a *building* divided by the floor area. *Site energy* is typically measured by a utility, energy supplier, or the *building owner*. *Source energy* is typically measured *site energy* multiplied by a *source energy* conversion factor. Emissions GHG emissions are also typically calculated from *site energy* multiplied by an emissions conversion factor.

Informative Appendix J – Delete Section J5.2 in its entirety.

J4.2 Source Energy Conversion Factors and Calculations. ~~Source energy estimates are based on site energy measurements multiplied by source energy factors. Source energy factors quantify the impacts of upstream energy lost in the production and delivery of the energy to the building.~~

~~Before benchmarking, the source energy factors to be used should be established. The jurisdiction can choose national source energy factors, such as those used in the ENERGY STAR[®] program; regional source energy factors, such as the U.S. regional source energy factors in ANSI/ASHRAE Standard 105^{N15}; Table K3 A; or local source energy factors. Local source energy factors can be calculated for each energy form using the methodology in ANSI/ASHRAE Standard 105, Appendices J and K, or can be obtained directly from the utility or energy supplier.~~

~~Source energy is obtained by multiplying the site energy of each energy form by its corresponding source energy factor:~~

~~where~~

$$\text{Source Energy} = \sum_i E_{\text{Site, Imported Energy Form } i} \times \text{SEF}_{\text{Imported Energy Form } i}$$

$E_{\text{Site, Imported Energy Form } i}$ = site energy from imported energy form i

$\text{SEF}_{\text{Imported Energy Form } i}$ = source energy factor for imported energy form i

Example J4.2: A building has the energy use and source energy factors from ASHRAE Standard 105, Table K-2, shown in Table J4-1:

$$\text{Source Energy} = E_{\text{Site, Grid Electricity}} \times \text{SEF}_{\text{Grid Electricity}} + E_{\text{Site, Natural Gas}} \times \text{SEF}_{\text{Natural Gas}}$$

$$\text{Source Energy (I-P)} = (100,000 \text{ kBtu/yr} \times 2.74) + (30,000 \text{ kBtu/yr} \times 1.09) = 306,700 \text{ kBtu/yr}$$

$$\text{Source Energy (SI)} = (105,500 \text{ MJ/yr} \times 2.74) + (31,700 \text{ MJ/yr} \times 1.09) = 323,623 \text{ MJ/yr}$$

This process is described in greater detail in ASHRAE Standard 105.

Table J4-1 Example Source Energy Calculation Inputs

Imported Energy Form	Annual Site Energy, kBtu/yr	Annual Site Energy, MJ/yr	Source Energy Factor
Grid electricity	100,000	105,500	2.74
Natural gas	30,000	31,700	1.09

Table J4-2 Example GHG Emissions Calculation Inputs

Imported Energy Form	Annual Site Energy (kBtu/yr)	Annual Site Energy, MJ/yr	GHG Emissions Factor, lb CO ₂ e/kBtu	GHG Emissions Factor, kg CO ₂ e/MJ
Grid electricity	100,000	105,500	0.326	0.140
Natural gas	30,000	31,700	0.147	0.063

The jurisdiction may allow *buildings* that receive the same form of energy from multiple suppliers to use different *source energy* factors. For example, a *building* may receive regional grid electricity from the local distribution company and from a specific electric generation supplier through a power purchase agreement. In this situation, each form of electricity supply can be converted to *source energy* using the corresponding *source energy* factor (regional factor for electricity from the local distribution company and custom factor for the power purchase agreement supplier). Source *EUI* is calculated by dividing the energy use by the gross floor area (square feet [I-P] or square metres [SI]).

Informative Appendix J – Revise the 1st paragraph in Section J4.3 as indicated.

J4.3 Greenhouse Gas Emissions Calculations. This standard considers energy related *GHG emissions* only and does not consider *GHG emissions* associated with refrigerant leakage, processes occurring at the *building* (e.g., anesthetic gases in healthcare *buildings*), water, or other material usage. Energy-related *GHG emissions* are calculated similarly to *source energy* use; they are based on *site energy* measurements multiplied by emission factors. Emissions directly produced by combustion at the *building* are known as “direct emissions.” Estimates derived for emissions-related processes used to deliver energy to the *building* are known as “indirect emissions.”

Informative Appendix J – Revise Section J5 as indicated.

J5. TARGET DEVELOPMENT PROCESS

Building performance targets (i.e., *site EUI*, ~~*source EUI*~~, or *GHGI*) are a set of metrics that *buildings* must meet. Once *building* data have been collected, metric type has been chosen, and *EUI* or *GHGI* metrics have been calculated, it is time to choose specific targets. Several potential strategies for setting targets are summarized in Table J5-1.

Informative Appendix J – Revise the equation in Section J5.1.2, following Figure J5.1, as indicated.

J5.1.2 Calculating Impact. Targets are primarily established to achieve specific energy or GHG goals. For any given target, we can project the equivalent percent improvement, defined as the energy or emission

Table J5-2 Example Data Set

Building	Floor Area, ft ²	Site EUI, kBtu/ft ² /yr
DP1	131,500	35
DP2	56,300	48
DP3	153,900	61
DP4	135,500	72
DP5	60,000	83
DP6	114,600	119
DP7	90,900	250

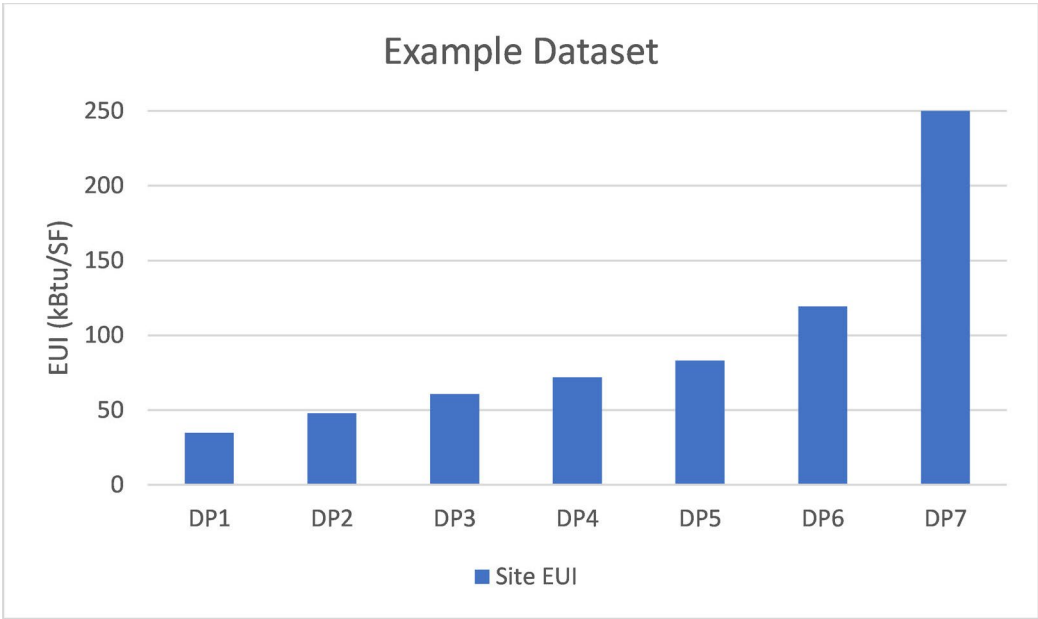


Figure J5-1 Example data set.

reduction that would be achieved if all *buildings* met the specific target. The projected percent improvement can be calculated by first defining the *baseline* and projected energy or emissions:

$$\text{Baseline Energy/Emissions} = \sum_i DP_i \times FA_i$$

$$P = \frac{\text{projected Energy/Emissions}}{\text{Baseline Energy/Emissions}}$$

$$\text{Emissions} = \sum_i \min(T, P_i) \times FA_i$$

where

DP_i = performance metric value for building *i* (these values are the site EUI, source EUI, or GHGI)

FA_i = floor area for building *i*

T = target (this value is site EUI, source EUI, or GHGI)

Informative Appendix J – Revise Section J5.2 and Example J5.2 as indicated.

J5.2 Mean-Based Targets. Set the target at the mean site *EUI* for each property type.

Example J5.2: Consider creating targets for a group of seven *buildings* ($n = 7$), ordered from lowest to highest *EUI* (Table J5-2).

Note: This example keeps the number small for simplicity’s sake, but this small number of buildings is not recommended to create targets as it is unlikely to reliably characterize the *building* stock.

The mean site *EUI* is 95 kBtu/ft²/yr. Setting the target at the mean *EUI* results in the site *EUI* reduction requirements shown in Table J5-3. Two *buildings* are required to lower their *EUI*, resulting in an overall percentage improvement of 25%.

Informative Appendix J – Revise item DP_i in the equation in Section J5.5 as indicated.

$$P_i = 100\% - \frac{\sum \min(DP_x, DP_i) \times SF_i}{\sum DP_i \times SF_i}$$

where

i = index of the data point (i.e., $i = 5$ is the 5th lowest value)

P_i = hypothetical percent improvement if DP_i were the target

DP_i = performance metric value for *building* i (these values are the site *EUI*, ~~source *EUI*~~, or *GHGI*)

SF_i = floor area for *building* i

DP_x = data point corresponding to the x lowest value in the *building* category’s data set

n = total number of data points in the *building* category’s data set

Informative Appendix J – Revise Section J6 as indicated.

J6. ENERGY USE INTENSITY TARGETS FOR U.S. HOSPITALS

Hospitals have high energy demands to protect patient health and are often the most energy-intensive facility in a community. ANSI/ASHRAE/IES Standard 100 recognizes limitations in the dataset referenced to develop the site *EUI* targets for U.S. inpatient hospitals. Locally derived targets may be difficult for *AHJs* because cities and counties may only have a few hospitals within their jurisdiction. However, the American Society for Health Care Engineering (ASHE) has published energy benchmarking for U.S. hospitals based on actual energy consumption for 950 hospitals from 2018 to 2022. This is a robust dataset from 45 states and the District of Columbia and can be referenced as an alternative *EUI target* for hospitals.

Informative Appendix J – Revise Section J6.3 as indicated.

J6.3 Energy Use Variation by Hospital Size. The ASHE dataset shows that energy consumption varies by hospital size. ASHE identifies four size categories for hospitals, as detailed in Table J6-2.

This standard allows a factor to be applied to site *EUI targets*, similar to “Ratios of Climate Zone *EUI*”; refer to Table G-1. The ASHE dataset shows that the median site *EUI* for small hospitals is statistically significantly different from medium and large hospitals. Based on 2022 data, the difference between medium and large hospitals is not statistically significant, and therefore no size factor applies. Unfortunately, there are insufficient data points available from critical access hospitals to present median site *EUIs* and size factors for these vital facilities that often serve smaller, remote communities.

J7. JURISDICTION-SPECIFIC METHODOLOGIES

Jurisdiction-specific methodologies (JSMs) can be found at www.ashrae.org/100Files. These contain calculations that apply to subnational geographic regions and are based on robust, region-specific datasets that provide evidence of *building* activity energy use by state, province, or city. Some jurisdictions have multiple climate zones and unique definitions of *building* archetypes that are reflected in the region-specific datasets. Regional characteristics may result in site or source EUI and GHGI that differ from the ANSI/ASHRAE/IES Standard 100 tables in Section 7 for the comparable climate zones. In addition, JSMs contain Standard 100 targets for those subnational jurisdictions

Add Informative Appendix Q

APPENDIX Q

INFORMATION RELATED TO SOURCE ENERGY TARGETS

For the purposes of this Appendix, the following definition applies:

Source energy: site energy plus the estimated energy consumed or lost in the extraction, processing, and transportation of primary energy forms such as coal, oil, natural gas, biomass, and nuclear fuel; energy consumed in conversion to other energy forms; and energy consumed or lost in transmission and distribution to the building site. See also primary energy.

Q1-1. Source Energy Conversion Factors. *Source energy* shall be calculated using Equation Q1-1:

$$\text{Source energy} = \text{Site energy}_1 \times \text{SEF}_1 + \dots + \text{Site energy}_i \times \text{SEF}_i + \dots + \text{Site energy}_n \times \text{SEF}_n \quad (\text{Q1-1})$$

1) where

Site energy_i = site energy associated with energy form i , where i equals 1 to n

SEF_i = source energy conversion factor associated with energy form i , where i equals 1 to n

The AHJ shall be permitted to

- Substitute the national electricity *source energy* conversion factor in Table Q1-1 with the appropriate regional factor in Table Q1-2 applicable to the *building* location
- Substitute other *source energy* conversion factors for electricity and other energy forms following the processes and procedures incorporated within ANSI/ASHRAE Standard 105 2
- Substitute other locally appropriate *source energy* conversion factors

Table Q1-1 U.S. Source Energy Conversion Factors

<u>Energy Form</u>		<u>Source Energy Conversion Factor</u>
<u>Grid electricity</u>		<u>2.74</u>
<u>Grid natural gas</u>		<u>1.09</u>
<u>Grid fuel oil</u>		<u>1.19</u>
<u>Grid liquefied petroleum gas (LPG) or propane</u>		<u>1.15</u>
<u>Coal</u>		<u>1.10</u>
<u>Other</u>		<u>Note a</u>
<u>Purchased district energy</u>	<u>Hot water</u>	<u>1.35</u>
	<u>Steam</u>	<u>1.45</u>

	Chilled Water	1.04
On-site renewable thermal energy production		Note b
On-site renewable electricity production		Note b

Notes:

c. To be approved by the AHJ.

d. To be approved by the AHJ.

Table Q1-2, U.S. Regional Electricity Source Energy Conversion Factors

<u>eGrid 2018 Sub-region Acronym</u>	<u>eGrid 2018 Sub-region Name</u>	<u>Source Energy Conversion Factor—Captured Energy Efficiency Approach</u>	<u>Source Energy Conversion Factor—Infinite Energy Efficiency Approach</u>
<u>AKGD</u>	<u>ASCC Alaska Grid</u>	<u>2.66</u>	<u>2.46</u>
<u>AKMS</u>	<u>ASCC Miscellaneous</u>	<u>1.91</u>	<u>1.21</u>
<u>ERCT</u>	<u>ERCOT All</u>	<u>2.51</u>	<u>2.31</u>
<u>FRCC</u>	<u>FRCC All</u>	<u>2.77</u>	<u>2.62</u>
<u>HIMS</u>	<u>HICC Miscellaneous</u>	<u>2.90</u>	<u>2.51</u>
<u>HIOA</u>	<u>HICC Oahu</u>	<u>3.51</u>	<u>3.06</u>
<u>MROE</u>	<u>MRO East</u>	<u>3.07</u>	<u>2.88</u>
<u>MROW</u>	<u>MRO West</u>	<u>2.69</u>	<u>2.35</u>
<u>NYLI</u>	<u>NPCC Long Island</u>	<u>3.36</u>	<u>2.79</u>
<u>NEWE</u>	<u>NPCC New England</u>	<u>2.77</u>	<u>2.26</u>
<u>NYCW</u>	<u>NPCC NYC/Westchester</u>	<u>2.94</u>	<u>2.88</u>
<u>NYUP</u>	<u>NPCC Upstate NY</u>	<u>2.23</u>	<u>1.72</u>
<u>RFCE</u>	<u>RFC East</u>	<u>2.95</u>	<u>2.83</u>
<u>RFCM</u>	<u>RFC Michigan</u>	<u>2.97</u>	<u>2.82</u>
<u>RFCW</u>	<u>RFC West</u>	<u>3.08</u>	<u>3.01</u>
<u>SRMW</u>	<u>SERC Midwest</u>	<u>3.14</u>	<u>3.08</u>
<u>SRMV</u>	<u>SERC Mississippi Valley</u>	<u>2.78</u>	<u>2.71</u>
<u>SRSO</u>	<u>SERC South</u>	<u>2.86</u>	<u>2.72</u>
<u>SRTV</u>	<u>SERC Tennessee Valley</u>	<u>2.94</u>	<u>2.81</u>
<u>SRVC</u>	<u>SERC Virginia/Carolina</u>	<u>2.99</u>	<u>2.81</u>
<u>SPNO</u>	<u>SPP North</u>	<u>2.67</u>	<u>2.37</u>
<u>SPSO</u>	<u>SPP South</u>	<u>2.61</u>	<u>2.31</u>
<u>CAMX</u>	<u>WECC California</u>	<u>2.07</u>	<u>1.55</u>
<u>NWPP</u>	<u>WECC Northwest</u>	<u>1.93</u>	<u>1.28</u>
<u>RMPA</u>	<u>WECC Rockies</u>	<u>2.59</u>	<u>2.27</u>
<u>AZNM</u>	<u>WECC Southwest</u>	<u>2.87</u>	<u>2.71</u>

Informative Note: Energy accounting and conversion factors shown in Tables Q1 and Q2 are based on *site energy* using the conversion factors in Table 5-1. Section 4.5.2 of this standard allows alternative *EUI targets* established by the adopting AHJ. The AHJ may use the captured energy efficiency approach or the infinite energy efficiency approach for regional conversion factors. For further information about these approaches, please see ANSI/ASHRAE Standard 105.

Q2, Source Energy Use Intensity Targets. *EUI targets* based on *source energy* are shown in Table Q2-1 in both I-P and SI units.

All *EUI targets* in the standard have been derived from 2012 Commercial Building Energy Consumption Survey (CBECS)³ and 2015 Residential Energy Consumption Survey (RECS)⁴ data by Oak Ridge National Laboratory (ORNL) and the U.S. Department of Energy (DOE) and represent the 25th bottom (low energy) percentile of energy use by each *building* category.

The median numbers for each *building* category from CBECS and RECS data representing all *buildings* in the *building* type/activity across all climatic conditions were extrapolated to 20 DOE climate zones using multipliers generated through simulation of a representative *building* for each group of *building* categories. Informative Appendix G gives a detailed explanation of *EUI target* table derivation.

Q2-1, Source Energy Use Intensity Targets with Custom Source Energy Conversion Factors. When an authority *having jurisdiction (AHJ)* uses a custom *source energy* conversion factor (any factors other than those in Table Q-1), it shall use Tables 7-5 and 7-6 to generate *source EUI targets* in conjunction with the *source energy* conversion factors used to calculate *source energy* in Section Q1. Performance targets shall be calculated using Equation Q2-1

$$EUI_{t1} = (ELUI_{t1} \times SEF_{el}) + (FEUI_{t1} \times SEF_{fe}) \quad \text{---(Q2-1)}$$

where

$ELUI_{t1}$ = electricity *EUI target* from Table 7-5 in Section 7 of the standard.

SEF_{el} = local *source energy* conversion factor for electricity use

$FEUI_{t1}$ = fossil-fuel *EUI target* from Table 7-6 in Section 7 of the standard.

SEF_{fe} = local *source energy* conversion factor for fossil-fuel energy use

Informative Note: Tables 7-5 and 7-6 should not be applied separately for individual energy sources.

Q2-2 *EUI targets* for *buildings* with a single activity shall be determined in accordance with Section 7.2.2 in the standard.

Q2-3 *EUI targets* for *buildings* with multiple activities shall be determined in accordance with Section 7.2.3 in the standard.

Table Q2-1a Building Activity Source Energy Use Intensity Targets (EUI_{tr}) (I-P)

		EUIs by Building Type by Climate Zone (kBtu/ft ² ·yr)																			
		ASHRAE Climate Zone																			
No.	Commercial Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
1	Admin/professional office	119	121	103	92	86	79	78	65	77	64	81	78	71	73	69	69	82	71	90	111
2	Bank/other financial	203	207	176	157	146	134	133	111	131	109	137	134	120	124	118	118	140	122	154	190
3	Government office	133	135	115	102	95	88	87	73	86	71	90	87	78	81	77	77	92	79	101	124
4	Medical office (nondiagnostic)	118	120	102	91	85	78	77	64	76	63	80	77	70	72	68	68	81	70	89	110
5	Mixed-use office	105	107	91	81	76	70	69	58	68	57	71	69	62	64	61	61	73	63	80	98
6	Other office	100	102	86	77	72	66	66	55	64	54	68	66	59	61	58	58	69	60	76	93
7	Laboratory	344	340	298	264	248	229	232	199	229	191	245	238	219	227	214	221	257	225	283	349
8	Distribution/shipping center	22	32	22	27	26	29	40	25	36	25	57	49	44	67	57	50	92	72	116	159
9	Nonrefrigerated warehouse	14	19	13	16	16	18	24	15	22	15	34	30	27	41	35	30	55	44	70	96
10	Convenience store	399	397	362	319	325	300	323	301	322	280	352	342	333	333	312	350	367	326	400	477
11	Convenience store with gas	449	447	408	360	367	339	364	340	363	315	397	385	375	375	352	395	413	368	451	538
12	Grocery store/food market	361	360	328	289	295	272	293	273	292	254	319	310	302	302	283	318	332	296	363	433
13	Other food sales	396	394	359	317	323	298	321	299	320	278	350	339	331	331	310	348	364	324	398	474
14	Fire station/police station	125	123	108	96	90	83	84	72	83	69	89	86	79	82	78	80	93	82	103	127
15	Other public order and safety	261	258	226	201	189	174	176	151	174	145	186	181	166	172	162	168	195	171	215	265
16	Medical office (diagnostic)	118	112	113	91	88	88	83	80	88	70	83	87	74	73	74	71	78	75	80	90
17	Clinic/other outpatient health	132	125	126	101	99	98	93	89	98	78	93	97	82	81	83	79	87	83	90	100
18	Refrigerated warehouse	185	183	161	142	134	123	125	107	124	103	132	129	118	122	115	119	138	121	153	188
19	Religious worship	62	61	54	48	45	41	42	36	41	34	44	43	39	41	39	40	46	41	51	63
20	Entertainment/culture	98	97	85	75	71	65	66	57	66	55	70	68	63	65	61	63	73	64	81	100
21	Library	154	152	133	118	111	102	104	89	103	85	110	107	98	102	96	99	115	101	127	156
22	Recreation	112	111	97	86	81	74	76	65	75	62	80	78	71	74	70	72	84	73	92	114
23	Social/meeting	103	102	89	79	74	68	69	60	69	57	73	71	66	68	64	66	77	67	85	105
24	Other public assembly	124	122	107	95	89	82	83	72	83	69	88	86	79	82	77	79	92	81	102	126
25	College/university	217	203	162	158	136	123	128	94	123	93	145	132	127	143	125	131	169	141	194	259

Table Q2-1a Building Activity Source Energy Use Intensity Targets (EUI_{IT}) (I-P) (Continued)

		EUIs by Building Type by Climate Zone (kBtu/ft²·yr)																			
		ASHRAE Climate Zone																			
No.	Residential Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
51	Mobile home	102	103	79	80	69	67	75	57	72	52	93	82	84	94	82	101	110	93	126	160
52	Single-family detached	87	87	67	68	59	56	64	48	61	44	79	70	71	80	69	74	94	79	107	136
53	Single-family attached	81	81	63	63	55	53	60	45	57	42	74	65	66	75	65	86	87	74	100	127
54	Apartment (in 2 to 4 unit <i>building</i>)	95	95	73	74	64	62	70	52	66	48	86	76	77	87	75	126	102	86	117	148
55	Apartment (in 5+ unit <i>building</i>)	75	75	58	59	51	49	55	42	53	39	69	61	62	69	60	86	81	68	93	118

Table 7-3b Building Activity Source Energy Use Intensity Targets (EUI_{IT}) (SI)

		EUIs by Building Type by Climate Zone (MJ/m ² ·yr)																			
		ASHRAE Climate Zone																			
No.	Commercial Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
1	Admin/professional office	1354	1378	1169	1045	975	893	887	741	873	726	915	891	801	824	784	784	934	809	1027	1264
2	Bank/other financial	2309	2349	1993	1782	1662	1523	1513	1263	1489	1238	1560	1519	1366	1405	1338	1337	1593	1380	1751	2155
3	Government office	1506	1533	1300	1163	1084	994	987	824	971	808	1018	991	891	916	873	872	1039	900	1142	1406
4	Medical office (nondiagnostic)	1337	1361	1155	1032	963	882	876	732	862	717	904	880	791	814	775	774	923	799	1014	1248
5	Mixed-use office	1197	1218	1033	924	862	790	784	655	772	642	809	787	708	728	693	693	826	715	908	1117
6	Other office	1136	1156	981	877	818	750	744	622	732	609	768	747	672	691	658	658	784	679	862	1060
7	Laboratory	3903	3862	3380	2999	2820	2595	2634	2257	2603	2167	2780	2708	2485	2576	2429	2505	2914	2558	3211	3966
8	Distribution/shipping center	255	359	244	308	297	333	458	286	414	280	644	561	502	764	651	565	1044	821	1314	1809
9	Nonrefrigerated warehouse	154	216	147	185	179	200	275	172	249	168	388	337	302	460	392	340	628	494	791	1089
10	Convenience store	4526	4507	4108	3627	3695	3412	3671	3422	3656	3177	3995	3879	3781	3780	3543	3978	4164	3706	4544	5421
11	Convenience store with gas	5101	5080	4630	4088	4165	3845	4137	3858	4121	3581	4503	4372	4262	4261	3994	4484	4694	4177	5122	6111
12	Grocery store/food market	4103	4085	3724	3287	3349	3093	3327	3102	3314	2880	3621	3516	3428	3427	3212	3606	3775	3359	4119	4914
13	Other food sales	4497	4478	4082	3604	3671	3390	3647	3401	3633	3157	3970	3854	3757	3756	3520	3953	4138	3682	4515	5387
14	Fire station/police station	1416	1401	1226	1088	1023	941	955	819	944	786	1008	982	901	934	881	909	1057	928	1165	1439
15	Other public order and safety	2964	2933	2567	2277	2142	1971	2000	1714	1977	1645	2111	2056	1887	1956	1845	1902	2213	1942	2438	3012

Table Q2-1b Building Activity Source Energy Use Intensity Targets (EUI_{tr}) (SI) (Continued)

		EUIs by Building Type by Climate Zone (MJ/m ² ·yr)																			
		ASHRAE Climate Zone																			
No.	Commercial Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
16	Medical office (diagnostic)	1340	1267	1287	1031	1004	994	948	909	995	789	942	990	838	825	844	806	884	849	912	1019
17	Clinic/other outpatient health	1495	1414	1436	1151	1120	1110	1058	1014	1111	881	1052	1105	936	921	942	899	987	947	1017	1138
18	Refrigerated warehouse	2105	2083	1823	1618	1521	1400	1421	1217	1404	1169	1500	1461	1340	1390	1310	1351	1572	1380	1732	2139
19	Religious worship	703	695	608	540	508	467	474	406	469	390	500	487	447	464	437	451	524	460	578	714
20	Entertainment/culture	1116	1104	966	857	806	742	753	645	744	620	795	774	710	737	695	716	833	731	918	1134
21	Library	1747	1729	1513	1343	1263	1162	1179	1010	1166	970	1245	1212	1112	1153	1088	1122	1304	1145	1438	1776
22	Recreation	1271	1258	1101	977	919	845	858	735	848	706	906	882	809	839	791	816	949	833	1046	1292
23	Social/meeting	1169	1156	1012	898	845	777	789	676	780	649	832	811	744	771	727	750	872	766	962	1188
24	Other public assembly	1405	1390	1216	1079	1015	934	948	812	937	780	1001	975	894	927	874	902	1049	921	1156	1427
25	College/university	2461	2308	1845	1794	1550	1392	1456	1065	1395	1058	1651	1501	1442	1619	1415	1493	1921	1605	2202	2946
26	Elementary/middle school	1211	1183	1003	927	829	772	779	651	765	629	837	813	741	775	728	733	888	775	1003	1328
27	High school	1778	1667	1332	1296	1120	1006	1051	770	1008	764	1193	1084	1042	1169	1022	1078	1388	1159	1591	2128
28	Preschool/daycare	1688	1650	1398	1292	1156	1077	1086	907	1066	877	1166	1133	1033	1081	1015	1021	1237	1081	1398	1851
29	Other classroom education	1022	999	846	782	700	652	657	549	645	531	706	686	625	654	614	618	749	654	846	1121
30	Fast food	8891	8766	8202	7066	6979	6756	6745	6216	6877	5978	7309	7255	6847	6970	6597	7153	7705	6872	8430	10092
31	Restaurant/cafeteria	6376	6207	5719	5018	4860	4671	4751	4248	4804	4138	5211	5165	4933	4952	4677	5203	5441	4887	5941	7084
32	Other food service	2236	2176	2005	1760	1704	1638	1666	1490	1684	1451	1827	1811	1730	1737	1640	1824	1908	1714	2083	2484
33	Hospital/inpatient health	5640	5746	5249	4503	4604	3963	4120	3926	4018	3796	4095	3993	3841	3448	3278	3613	3604	3286	3690	4032
34	Nursing home/assisted living	2422	2430	1876	1887	1634	1576	1786	1340	1703	1241	2211	1949	1985	2232	1932	2168	2615	2203	2992	3784
35	Dormitory/ fraternity/sorority	1268	1272	982	988	855	825	935	702	891	650	1157	1020	1039	1168	1011	1135	1369	1153	1566	1981
36	Hotel	1486	1417	1327	1130	1155	1039	1095	1060	1084	960	1180	1162	1097	1109	1066	1147	1224	1103	1326	1556
37	Motel or inn	1578	1553	1417	1202	1138	1062	995	962	1030	913	984	1021	913	882	873	917	950	859	995	1126
38	Other lodging	1883	1853	1691	1434	1358	1268	1187	1148	1229	1090	1174	1219	1090	1053	1041	1095	1134	1025	1188	1343
39	Vehicle dealership/ showroom	1350	1357	1141	1047	983	912	1000	750	962	741	1127	1063	987	1131	1031	1076	1341	1147	1545	1997
40	Retail store	1119	1125	946	868	815	756	829	621	797	614	934	881	818	937	855	892	1112	951	1281	1655
41	Other retail	1570	1579	1327	1218	1144	1061	1164	872	1118	862	1311	1237	1148	1315	1200	1252	1560	1334	1797	2323

Table Q2-1b Building Activity Source Energy Use Intensity Targets (EUI₁₇) (SI) (Continued)

EUIs by Building Type by Climate Zone (MJ/m ² ·yr)																					
		ASHRAE Climate Zone																			
No.	Commercial Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
42	Post office/postal center	1384	1388	1072	1078	933	900	1020	766	973	709	1263	1114	1134	1275	1104	1239	1494	1259	1709	2162
43	Repair shop	308	432	295	371	358	401	552	345	499	337	777	676	605	921	785	681	1258	990	1584	2181
44	Vehicle service/repair shop	393	553	377	475	458	513	705	441	638	431	993	864	774	1178	1004	871	1609	1266	2026	2788
45	Vehicle storage/ maintenance	294	413	281	354	342	383	527	329	476	322	742	645	578	880	749	650	1201	945	1513	2082
46	Other service	424	596	406	512	494	554	761	475	688	465	1072	932	835	1271	1083	940	1736	1366	2185	3008
47	Strip shopping mall	2434	2458	2070	1905	1712	1609	1730	1299	1681	1321	1968	1845	1746	1987	1789	1885	2347	2007	2705	3491
48	Enclosed mall	1464	1479	1245	1146	1030	968	1041	781	1011	794	1184	1110	1050	1195	1076	1134	1412	1207	1627	2100
49	Bar/pub/lounge	2779	2705	2492	2187	2118	2035	2070	1851	2093	1803	2271	2251	2150	2158	2038	2267	2371	2130	2589	3087
50	Courthouse/probation office	2478	2424	2153	1867	1842	1574	1674	1438	1572	1406	1741	1590	1527	1487	1371	1425	1664	1419	1798	2166
EUIs by Building Type by Climate Zone (MJ/m ² ·yr)																					
		ASHRAE Climate Zone																			
No.	Residential Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
51	Mobile home	424	425	328	404	343	341	411	290	369	289	514	422	462	592	501	556	693	604	797	984
52	Single-family detached	360	361	279	343	292	290	349	247	313	245	437	359	392	502	426	409	589	513	677	835
53	Single-family attached	336	337	260	320	272	271	325	230	292	229	407	335	366	469	397	477	549	478	632	780
54	Apartment (in 2 to 4 unit building)	392	393	303	374	318	316	380	269	341	267	475	391	427	547	463	693	641	558	737	909
55	Apartment (in 5+ unit building)	312	313	242	297	253	251	302	214	272	213	378	311	340	435	369	477	510	444	587	724

Q3, Source Energy Use Intensity Calculation Table. When source energy is used as a basis for meeting a building's energy use intensity, source energy consumption shall be documented using Form Q-1. The starting point for the source energy calculation is site energy usage, which will be documented using Form C-1 in normative appendix C.

Form Q-1 — Source Energy Use Intensity Calculation Table

	Energy Form^a	Annual Site Energy (Form C-1, Column F), kBtu/yr (MJ/yr)	Source Energy Conversion Factor^b	Annual Source Energy, kBtu/yr (MJ/yr)
1a.	Imported grid electricity			
1b.	Imported specific renewable electricity ^c			
2a.	Imported grid natural gas			
2b.	Imported specific renewable natural gas ^c			
3.	Imported steam			
4.	Imported hot water			
5.	Imported chilled water			
6a.	Imported grid fuel oil			
6b.	Imported specific renewable fuel oil ^c			
7a.	Imported grid propane			
7b.	Imported specific renewable propane ^c			
8.	Imported coal or other ^d			
9.	Imported biofuels			
10.	On-site <i>nonrenewable energy</i>			
11.	Imported transportation vehicle energy			
12.	Exported electricity			
13.	Exported steam			
14.	Exported hot water			
15.	Exported chilled water			
16.	Exported other ^d			
17.	Exported transportation vehicle energy			
	Annual Source Energy^e (Sum of 1 to 11 minus Sum of 12 to 17), kBtu (MJ)			
	Source Energy Use Intensity (gross energy/gross floor area [from Form B]), kBtu/ft² (MJ/ft²)			

Notes:

- f. Grid energy forms are from the electric grid, fuel utility, or distribution system. Specific renewable energy forms are from a specific provider meeting the requirements of the adopting authority.
- g. See Table Q1-1 and/or Table Q1-2 in Section Q1.
- h. Documentation of specific off-site renewable energy ownership or procurement shall be submitted to the adopting authority. For procurement, the purchase contract shall have a duration of not less than 15 years.
- i. If there is more than one "other" energy form, the entry shall be split, or additional notations made to so indicate.
- j. When the imported energy meter records the imported energy minus the exported energy under a net metering agreement, exported energy shall not be double counted.

Q4, Alternate Source Energy Intensity Targets.

Q4-1, Alternative Source Energy Use Intensity Target Tables. The alternative source energy use intensity targets listed in Table Q-2 and fuel-specific targets listed in Tables Q-3 and Q-4 for use in target calculations by *authorities having jurisdiction* were derived from Commercial Building Energy Consumption Survey (CBECS) 2012 and Residential Energy Consumption Survey (RECS) 2015 data by Oakridge National Lab (ORNL) and the U.S. Department of Energy (DOE) and represent the 40th bottom (low energy) percentile of energy use by each *building* category.

The median numbers for each *building* category from CBECS and RECS data representing all *buildings* in the *building* category across all climatic conditions were extrapolated to 20 DOE climate zones using multipliers generated through simulation of representative *building* for each group of *building* categories. Climate Zone 5C values are based on U.S. *building* stock (a Canadian *building* sample was not available at the time of table development.) Refer to Informative Appendix G for further information on derivation of energy use targets.

Q4-1-1 Alternative Source Energy Use Intensity Target Calculations. Electricity use and fossil-fuel use targets listed in Tables Q-3 and Q-4 shall be permitted to be used in *source energy EUI target* (EUI_{t1}) calculations by *authorities having jurisdiction* in accordance with Equation Q-1.

$$EUI_{t1} = ELUI_{t1} \times SEF_{el} + FEUI_{t1} \times SEF_{fe} \quad (Q-1)$$

where

$ELUI_{t1}$ = local electricity *EUI target* from Table Q-3

SEF_{el} = local *source energy* conversion factor for electricity

$FEUI_{t1}$ = local fossil-fuel *EUI target* from Table Q-4

SEF_{fe} = local *source energy* conversion factor for fossil-fuel energy use

Informative Note: Tables Q-3 and Q-4 should not be applied separately for individual energy sources. The tables are used in accordance with Equation Q-1 to determine the appropriate *source energy* target.

Table O4-1a Alternative Building Activity Source Energy Use Intensity Targets (I-P)**EUIs by Building Type by Climate Zone (kBtu/ft²·yr)**

		ASHRAE Climate Zone																			
No.	Commercial Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
1	Admin/professional office	145	147	125	112	104	96	95	79	93	78	98	95	86	88	84	84	100	87	110	135
2	Bank/other financial	247	251	213	191	178	163	162	135	159	132	167	162	146	150	143	143	170	148	187	230
3	Government office	161	164	139	124	116	106	106	88	104	86	109	106	95	98	93	93	111	96	122	150
4	Medical office (nondiagnostic)	143	146	123	110	103	94	94	78	92	77	97	94	85	87	83	83	99	85	108	133
5	Mixed-use office	128	130	110	99	92	84	84	70	83	69	86	84	76	78	74	74	88	76	97	119
6	Other office	121	124	105	94	87	80	80	66	78	65	82	80	72	74	70	70	84	73	92	113
7	Laboratory	417	413	361	321	302	277	282	241	278	232	297	290	266	275	260	268	312	273	343	424
8	Distribution/shipping center	27	38	26	33	32	36	49	31	44	30	69	60	54	82	70	60	112	88	141	193
9	Nonrefrigerated warehouse	16	23	16	20	19	21	29	18	27	18	41	36	32	49	42	36	67	53	85	116
10	Convenience store	484	482	439	388	395	365	392	366	391	340	427	415	404	404	379	425	445	396	486	580
11	Convenience store with gas	545	543	495	437	445	411	442	412	441	383	481	467	456	456	427	479	502	447	548	653
12	Grocery store/food market	439	437	398	352	358	331	356	332	354	308	387	376	366	366	343	386	404	359	440	525
13	Other food sales	481	479	436	385	393	362	390	364	388	338	424	412	402	402	376	423	442	394	483	576
14	Fire station/police station	151	150	131	116	109	101	102	88	101	84	108	105	96	100	94	97	113	99	125	154
15	Other public order and safety	317	314	274	244	229	211	214	183	211	176	226	220	202	209	197	203	237	208	261	322
16	Medical office (diagnostic)	143	135	138	110	107	106	101	97	106	84	101	106	90	88	90	86	95	91	97	109
17	Clinic/other outpatient health	160	151	154	123	120	119	113	108	119	94	112	118	100	98	101	96	106	101	109	122
18	Refrigerated warehouse	225	223	195	173	163	150	152	130	150	125	160	156	143	149	140	144	168	148	185	229
19	Religious worship	75	74	65	58	54	50	51	43	50	42	54	52	48	50	47	48	56	49	62	76
20	Entertainment/culture	119	118	103	92	86	79	81	69	80	66	85	83	76	79	74	77	89	78	98	121
21	Library	187	185	162	144	135	124	126	108	125	104	133	130	119	123	116	120	139	122	154	190
22	Recreation	136	135	118	104	98	90	92	79	91	75	97	94	87	90	85	87	101	89	112	138
23	Social/meeting	125	124	108	96	90	83	84	72	83	69	89	87	80	82	78	80	93	82	103	127
24	Other public assembly	150	149	130	115	109	100	101	87	100	83	107	104	96	99	93	96	112	98	124	153
25	College/university	263	247	197	192	166	149	156	114	149	113	177	160	154	173	151	160	205	172	235	315

Table Q4-1a Alternative Building Activity Source Energy Use Intensity Targets (I-P) (Continued)

		EUIs by Building Type by Climate Zone (kBtu/ft²·yr)																			
		ASHRAE Climate Zone																			
No.	Commercial Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
26	Elementary/middle school	129	127	107	99	89	83	83	70	82	67	89	87	79	83	78	78	95	83	107	142
27	High school	190	178	142	139	120	108	112	82	108	82	128	116	111	125	109	115	148	124	170	228
28	Preschool/daycare	180	176	149	138	124	115	116	97	114	94	125	121	110	116	109	109	132	116	149	198
29	Other classroom education	109	107	90	84	75	70	70	59	69	57	75	73	67	70	66	66	80	70	90	120
30	Fast food	951	937	877	756	746	722	721	665	735	639	781	776	732	745	705	765	824	735	901	1079
31	Restaurant/cafeteria	682	664	611	537	520	499	508	454	514	442	557	552	527	530	500	556	582	523	635	757
32	Other food service	239	233	214	188	182	175	178	159	180	155	195	194	185	186	175	195	204	183	223	266
33	Hospital/inpatient health	603	614	561	482	492	424	441	420	430	406	438	427	411	369	350	386	385	351	395	431
34	Nursing home/assisted living	259	260	201	202	175	169	191	143	182	133	236	208	212	239	207	232	280	236	320	405
35	Dormitory/ fraternity/sorority	136	136	105	106	91	88	100	75	95	69	124	109	111	125	108	121	146	123	167	212
36	Hotel	159	151	142	121	124	111	117	113	116	103	126	124	117	119	114	123	131	118	142	166
37	Motel or inn	169	166	152	129	122	114	106	103	110	98	105	109	98	94	93	98	102	92	106	120
38	Other lodging	201	198	181	153	145	136	127	123	131	117	126	130	117	113	111	117	121	110	127	144
39	Vehicle dealership/ showroom	144	145	122	112	105	98	107	80	103	79	121	114	106	121	110	115	143	123	165	214
40	Retail store	120	120	101	93	87	81	89	66	85	66	100	94	87	100	91	95	119	102	137	177
41	Other retail	168	169	142	130	122	113	124	93	120	92	140	132	123	141	128	134	167	143	192	248
42	Post office/postal center	148	148	115	115	100	96	109	82	104	76	135	119	121	136	118	132	160	135	183	231
43	Repair shop	33	46	31	40	38	43	59	37	53	36	83	72	65	98	84	73	135	106	169	233
44	Vehicle service/repair shop	42	59	40	51	49	55	75	47	68	46	106	92	83	126	107	93	172	135	217	298
45	Vehicle storage/ maintenance	31	44	30	38	37	41	56	35	51	34	79	69	62	94	80	70	128	101	162	223
46	Other service	45	64	43	55	53	59	81	51	74	50	115	100	89	136	116	100	186	146	234	322
47	Strip shopping mall	260	263	221	204	183	172	185	139	180	141	210	197	187	212	191	202	251	215	289	373
48	Enclosed mall	157	158	133	123	110	103	111	84	108	85	127	119	112	128	115	121	151	129	174	225
49	Bar/pub/lounge	297	289	266	234	226	218	221	198	224	193	243	241	230	231	218	242	254	228	277	330
50	Courthouse/probation office	265	259	230	200	197	168	179	154	168	150	186	170	163	159	147	152	178	152	192	232

Table Q4-1a Alternative Building Activity Source Energy Use Intensity Targets (I-P) (Continued)

		EUIs by Building Type by Climate Zone (kBtu/ft2·yr)																			
		ASHRAE Climate Zone																			
No.	Residential Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
51	Mobile home	124	125	96	97	84	81	92	69	87	64	113	100	102	114	99	123	134	113	153	194
52	Single-family detached	105	106	82	82	71	69	78	58	74	54	96	85	86	97	84	90	114	96	130	165
53	Single-family attached	98	99	76	77	66	64	73	54	69	50	90	79	81	91	79	105	106	90	122	154
54	Apartment (in 2 to 4 unit <i>building</i>)	115	115	89	89	77	75	85	64	81	59	105	92	94	106	92	153	124	104	142	179
55	Apartment (in 5+ unit <i>building</i>)	91	92	71	71	62	59	67	51	64	47	83	74	75	84	73	105	99	83	113	143

Table Q4-1b Alternative Building Activity Source Energy Use Intensity Targets (SI)

		EUIs by Building Type by Climate Zone (MJ/m2·yr)																			
		ASHRAE Climate Zone																			
No.	Commercial Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
1	Admin/professional office	1644	1673	1419	1269	1184	1085	1077	900	1060	882	1111	1082	973	1000	953	952	1135	983	1247	1535
2	Bank/other financial	2803	2853	2420	2164	2019	1850	1837	1534	1808	1503	1894	1844	1659	1706	1624	1623	1935	1676	2126	2617
3	Government office	1829	1861	1579	1412	1317	1207	1199	1001	1179	981	1236	1203	1082	1113	1060	1059	1262	1093	1387	1707
4	Medical office (nondiagnostic)	1624	1653	1402	1254	1169	1072	1064	889	1047	871	1097	1068	961	988	941	940	1121	971	1232	1516
5	Mixed-use office	1453	1479	1255	1122	1046	959	952	795	937	779	982	956	860	884	842	841	1003	869	1102	1356
6	Other office	1379	1404	1191	1065	993	910	904	755	889	740	932	908	816	839	799	799	952	825	1046	1288
7	Laboratory	4739	4689	4104	3641	3425	3151	3198	2740	3161	2631	3376	3288	3017	3128	2950	3042	3538	3106	3899	4816
8	Distribution/shipping center	310	435	297	374	361	404	556	347	502	340	783	681	610	928	791	686	1268	997	1596	2197
9	Nonrefrigerated warehouse	187	262	179	225	217	243	334	209	302	204	471	410	367	559	476	413	763	600	961	1322
10	Convenience store	5496	5473	4988	4404	4487	4143	4457	4156	4439	3858	4851	4710	4592	4590	4302	4831	5056	4500	5518	6583
11	Convenience store with gas	6195	6169	5622	4964	5057	4670	5024	4684	5004	4348	5468	5309	5176	5174	4849	5445	5699	5072	6219	7420
12	Grocery store/food market	4982	4961	4521	3992	4067	3755	4040	3767	4024	3497	4397	4270	4162	4161	3900	4379	4583	4079	5002	5967
13	Other food sales	5461	5438	4956	4376	4458	4116	4429	4129	4411	3833	4820	4680	4562	4561	4275	4800	5024	4471	5483	6541
14	Fire station/police station	1719	1701	1489	1321	1242	1143	1160	994	1147	954	1224	1193	1094	1135	1070	1103	1283	1127	1414	1747
15	Other public order and safety	3599	3561	3117	2765	2601	2393	2429	2081	2401	1998	2564	2497	2291	2376	2240	2310	2687	2359	2961	3657

Table Q4-1b Alternative Building Activity Source Energy Use Intensity Targets (SI) (Continued)

		EUIs by Building Type by Climate Zone (MJ/m ² ·yr)																			
		ASHRAE Climate Zone																			
No.	Commercial Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
16	Medical office (diagnostic)	1627	1539	1563	1252	1219	1207	1151	1104	1208	959	1144	1202	1018	1002	1025	978	1074	1030	1107	1238
17	Clinic/other outpatient health	1816	1717	1744	1397	1361	1347	1285	1232	1349	1070	1277	1342	1136	1118	1144	1092	1199	1150	1235	1381
18	Refrigerated warehouse	2556	2529	2214	1964	1847	1700	1725	1478	1705	1419	1821	1774	1627	1687	1591	1641	1908	1675	2103	2598
19	Religious worship	853	844	739	656	617	567	576	493	569	474	608	592	543	563	531	548	637	559	702	867
20	Entertainment/culture	1355	1341	1173	1041	979	901	914	783	904	752	965	940	863	894	843	870	1012	888	1115	1377
21	Library	2122	2099	1837	1630	1533	1411	1432	1227	1415	1178	1511	1472	1351	1401	1321	1362	1584	1391	1746	2156
22	Recreation	1544	1528	1337	1186	1116	1027	1042	893	1030	857	1100	1071	983	1019	961	991	1153	1012	1270	1569
23	Social/meeting	1419	1404	1229	1090	1026	944	958	821	947	788	1011	985	903	937	883	911	1059	930	1168	1442
24	Other public assembly	1705	1688	1477	1311	1233	1134	1151	986	1138	947	1215	1183	1086	1126	1062	1095	1273	1118	1403	1733
25	College/university	2988	2803	2240	2178	1882	1691	1767	1294	1694	1284	2005	1822	1751	1966	1718	1812	2333	1949	2674	3578
26	Elementary/middle school	1470	1437	1217	1125	1007	938	946	790	929	764	1016	987	900	941	884	890	1078	941	1217	1612
27	High school	2159	2025	1618	1574	1359	1221	1277	935	1223	928	1448	1316	1265	1420	1241	1309	1685	1408	1931	2584
28	Preschool/daycare	2050	2003	1697	1569	1404	1308	1319	1102	1295	1065	1416	1376	1254	1312	1232	1240	1503	1312	1697	2248
29	Other classroom education	1241	1213	1027	950	850	792	798	667	784	644	857	833	759	794	746	751	910	794	1027	1361
30	Fast food	10796	10644	9960	8581	8474	8203	8190	7548	8351	7259	8875	8810	8314	8463	8011	8686	9356	8345	10237	12254
31	Restaurant/cafeteria	7743	7536	6944	6093	5901	5672	5769	5158	5833	5025	6327	6272	5990	6013	5680	6317	6607	5935	7214	8602
32	Other food service	2715	2643	2435	2137	2069	1989	2023	1809	2045	1762	2219	2199	2101	2109	1992	2215	2317	2081	2530	3016
33	Hospital/inpatient health	6848	6978	6373	5468	5590	4812	5003	4767	4879	4610	4973	4849	4664	4187	3981	4388	4376	3991	4481	4895
34	Nursing home/assisted living	2942	2951	2278	2291	1984	1914	2169	1627	2068	1507	2684	2367	2410	2710	2346	2633	3175	2675	3633	4595
35	Dormitory/ fraternity/sorority	1540	1545	1192	1199	1038	1002	1135	852	1082	789	1405	1239	1261	1418	1228	1378	1662	1400	1902	2405
36	Hotel	1804	1720	1612	1372	1403	1262	1329	1287	1316	1166	1433	1411	1332	1346	1295	1392	1486	1340	1610	1889
37	Motel or inn	1916	1885	1721	1460	1382	1290	1208	1168	1251	1109	1195	1240	1109	1072	1060	1114	1154	1043	1209	1367
38	Other lodging	2287	2249	2053	1742	1649	1539	1441	1394	1492	1323	1426	1480	1323	1279	1264	1329	1376	1245	1442	1631
39	Vehicle dealership/ showroom	1639	1648	1386	1272	1194	1108	1215	910	1168	900	1369	1291	1199	1373	1252	1307	1629	1393	1876	2425
40	Retail store	1359	1366	1149	1054	990	918	1007	755	968	746	1135	1070	994	1138	1038	1083	1350	1154	1555	2010

Table Q4-1b Alternative Building Activity Source Energy Use Intensity Targets (SI) (Continued)

		EUIs by Building Type by Climate Zone (MJ/m ² ·yr)																			
		ASHRAE Climate Zone																			
No.	Commercial Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
41	Other retail	1906	1917	1612	1480	1389	1288	1413	1059	1358	1047	1592	1502	1394	1597	1457	1520	1895	1620	2182	2821
42	Post office/postal center	1680	1686	1301	1309	1133	1093	1239	930	1181	861	1534	1352	1377	1548	1341	1504	1814	1528	2076	2625
43	Repair shop	374	525	358	451	435	487	670	418	606	409	943	821	735	1118	953	827	1528	1202	1923	2648
44	Vehicle service/repair shop	478	671	457	576	556	623	856	535	774	523	1206	1049	939	1430	1219	1058	1954	1537	2460	3386
45	Vehicle storage/ maintenance	357	501	342	430	415	465	640	400	578	391	901	784	702	1068	910	790	1459	1148	1837	2528
46	Other service	515	724	494	622	600	672	924	577	835	565	1301	1132	1014	1543	1315	1141	2108	1658	2654	3653
47	Strip shopping mall	2956	2985	2514	2313	2079	1954	2101	1577	2041	1604	2389	2241	2120	2412	2172	2289	2850	2437	3284	4238
48	Enclosed mall	1778	1795	1512	1391	1251	1175	1264	949	1228	965	1437	1348	1275	1451	1307	1377	1714	1466	1976	2550
49	Bar/pub/lounge	3374	3284	3026	2655	2571	2472	2514	2248	2542	2190	2757	2733	2610	2621	2475	2753	2879	2586	3144	3748
50	Courthouse/probation office	3009	2943	2615	2268	2237	1911	2032	1746	1909	1707	2114	1931	1854	1806	1665	1730	2021	1723	2184	2630
		EUIs by Building Type by Climate Zone (MJ/m ² ·yr)																			
		ASHRAE Climate Zone																			
No.	Residential Building Type	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
51	Mobile home	1410	1415	1092	1098	951	918	1040	780	991	722	1287	1135	1156	1299	1125	1392	1522	1283	1742	2203
52	Single-family detached	1197	1201	927	933	808	779	883	663	842	613	1093	964	981	1103	955	1022	1293	1089	1479	1871
53	Single-family attached	1118	1121	865	871	754	727	824	618	786	573	1020	899	916	1030	892	1193	1206	1017	1380	1746
54	Apartment (in 2 to 4 unit <i>building</i>)	1304	1308	1010	1016	879	848	961	721	917	668	1190	1049	1068	1201	1040	1732	1408	1186	1611	2037
55	Apartment (in 5+ unit <i>building</i>)	1038	1041	804	808	700	675	765	574	730	532	947	835	850	956	828	1193	1120	944	1282	1621

Q5, Derivation of Source Energy Intensity Targets for Standard 100. Informative Appendix G describes how site energy intensity targets for Standard 100 were derived. The process for the derivation of source energy intensity targets would be similar. Table Q-5 shows the source-energy-based equivalent of Table 7-3, source energy EUI targets (In Appendix G, Table G-4 shows the site-based equivalent of Table 7-2). The different forms (site or source) have distinct advantages depending on the goal of the user or authority. Both could provide equivalent, alternate methods of complying with the efficient *building* targets of Standard 100 (if the source-based alternative were added) or serve as high-performance *building* targets for other standards, codes, programs, or entities.

Note:

3. Source energy (also called *primary energy*) represents and accounts for the raw fuel (energy) that is consumed to create heat or generate electricity for the end user or *building* (see ASHRAE Standard 105^{N15} for additional information). This is sometimes an important consideration because as much as three units of raw fuel (energy) may be required to generate a single unit of energy for the end user or *building*, such as for electricity supplied by the grid or heat received from a district heating system.

Table Q5-1, Building Total Energy Use Intensity Targets (Source Energy)



Energy Use Targets by Building Activity (EUI) (I-P Units) ¹																		
No.	Commercial Building Type	EUIs by Building Type by Climate Zone (source kBtu/ft ² -yr)																
		ASHRAE Climate Zone																
		1A	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C ²	6A	6B	7	8
1	Admin/professional office	123	127	113	130	95	112	93	109	91	118	91	90	91	101	94	109	152
2	Bank/other financial	174	180	161	185	134	159	133	155	129	167	129	128	131	143	134	154	216
3	Government office	153	158	142	162	118	140	117	136	113	147	113	113	115	126	117	136	190
4	Medical office(non-diagnostic)	105	108	97	111	81	95	80	93	77	100	77	77	77	86	80	93	130
5	Mixed-use office	142	146	131	151	110	130	108	126	105	136	105	104	105	116	109	126	176
6	Other office	119	122	110	126	91	108	90	105	87	114	88	87	89	97	91	105	147
7	Laboratory	561	555	493	548	425	477	446	463	397	522	394	404	424	436	421	468	622
8	Distribution/shipping center	39	49	48	62	31	51	40	64	52	64	67	65	56	92	80	113	212
9	Nonrefrigerated warehouse	19	24	23	30	15	25	19	31	25	31	32	31	28	45	39	55	102
10	Convenience store	424	460	391	476	367	401	396	396	343	458	337	349	391	364	357	392	494
11	Convenience store with gas	341	370	315	384	296	323	319	319	276	369	271	281	316	293	287	316	398
12	Grocery store/food market	353	383	326	397	306	334	330	330	286	382	281	291	325	303	297	326	412
13	Other food sales	107	116	99	120	93	101	100	100	87	116	85	88	98	92	90	99	125
14	Fire station/police station	207	204	182	202	156	176	164	170	146	192	145	149	157	160	155	172	229
15	Other public order and safety	188	186	166	184	142	160	150	155	133	175	132	136	143	146	141	157	209
16	Medical office (diagnostic)	105	102	94	100	87	93	75	76	70	82	57	64	66	58	60	58	66
17	Clinic/other outpatient health	158	152	141	150	130	139	112	114	105	123	86	96	98	88	90	86	98
18	Refrigerated warehouse	217	215	191	212	164	185	173	179	154	202	153	156	164	169	163	181	241
19	Religious worship	74	73	65	72	56	63	59	61	52	69	52	53	56	57	55	62	82
20	Entertainment/culture	73	72	64	71	55	62	58	60	52	68	51	53	56	57	55	61	81
21	Library	193	191	170	188	146	164	153	159	137	179	136	139	145	150	145	161	214
22	Recreation	83	82	73	81	63	71	66	69	59	77	58	60	63	65	62	69	92
23	Social/meeting	87	86	76	85	66	74	69	72	61	81	61	62	66	67	65	72	96
24	Other public assembly	89	88	78	87	67	76	71	73	63	83	62	64	68	69	67	74	99
25	College/university	194	193	175	196	130	169	142	175	141	190	154	145	156	177	160	194	288
26	Elementary/middle school	119	117	104	117	88	101	90	97	82	105	80	79	82	87	82	92	135
27	High school	142	141	127	143	95	123	103	125	100	138	108	103	110	124	113	136	201
28	Preschool/daycare	153	151	134	151	113	130	115	125	106	136	103	102	108	112	105	119	175
29	Other classroom education	79	79	71	80	53	69	58	70	56	77	60	57	63	69	63	76	113
30	Fast food	824	844	759	868	685	768	708	730	642	828	626	650	691	683	664	739	934
31	Restaurant/cafeteria	445	458	407	471	364	412	384	396	347	455	338	351	389	367	360	400	504
32	Other food service	243	250	222	258	199	225	210	216	190	248	185	192	213	201	197	219	275
33	Hospital/inpatient health	446	450	405	442	386	399	365	343	295	394	262	273	316	267	260	270	311
34	Nursing home/assisted living	265	262	233	259	200	225	210	218	187	246	186	191	199	206	199	221	294
35	Dormitory/fraternity/sorority	127	134	122	148	91	125	112	138	111	158	123	119	122	141	132	160	224
36	Hotel	156	160	140	161	135	141	135	131	119	153	108	118	124	115	117	122	141
37	Motel or inn	175	166	151	160	138	146	130	123	114	140	100	109	115	105	104	108	129
38	Other lodging	167	158	145	152	132	139	124	118	109	133	95	104	110	100	100	103	123
39	Vehicle dealership/showroom	154	158	141	165	109	138	118	142	119	151	128	126	136	147	138	163	234
40	Retail store	88	90	81	94	62	79	68	82	68	87	73	72	77	84	79	93	134
41	Other retail	154	157	141	164	108	137	118	142	118	151	127	126	133	146	137	162	233
42	Post office/postal center	134	133	118	131	102	114	107	111	95	125	94	97	101	104	101	112	149
43	Repair shop	90	89	79	87	68	76	71	74	63	83	63	64	68	70	67	75	99
44	Vehicle service/repair shop	104	103	91	101	79	88	82	86	73	97	73	75	77	81	78	87	115
45	Vehicle storage/maintenance	45	45	40	44	34	38	36	37	32	42	32	32	35	35	34	38	50
46	Other service	190	188	167	185	144	161	151	157	134	176	133	137	143	147	142	158	210
47	Strip shopping mall	186	185	167	194	132	165	143	171	142	185	154	152	166	177	167	199	284
48	Enclosed mall	177	176	159	185	126	157	136	163	135	176	147	144	159	169	159	189	270
49	Mobile home	119	126	115	139	86	118	106	130	104	148	116	112	115	133	124	151	210
50	SF-detached	89	94	85	104	64	88	79	96	77	110	86	83	84	98	92	112	156
51	SF-attached	102	108	98	119	73	101	90	111	89	127	99	96	98	113	106	129	180
52	Aptmt-in 2-4 unit	150	158	144	175	107	148	133	163	131	186	146	141	143	166	156	189	264
53	Aptmt in 5+ unit	102	108	98	119	73	101	90	111	89	126	99	96	98	113	106	129	180

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

² Zone 5C values based on U.S. building stock (A Canadian building sample was not available at the time of table development.)

Note: Site to source multipliers used to create Table 2: electricity- 3.15 kBtu source/kWh site; fossil fuel- 1.09 kBtu source/kBtu site, except for College/University buildings where fossil fuel- 1.22 kBtu source/kBtu site was used (since often on district heating systems).

O6, Guidance for Locally Derived Building Performance Standards. Informative Appendix J provides guidance on how to generate building performance targets based on local energy benchmarking data. Appendix J focuses on site energy use and greenhouse gas emissions. However, its guidance also applies to source energy use.

Q6-1, Table Q6-1 contains information on emissions metrics related to local derivation.

Table Q6-1 Comparison of Site Energy, Source Energy, and GHG Emissions Matrix

<u>Concept</u>	<u>Site Energy</u>	<u>Source Energy</u>	<u>GHG Emissions</u>
<u>Data complexity</u>	• <u>Most relatable to <i>building owners/operators/occupants</i>.</u> • <u>Data are accurately measurable by third parties and/or <i>building operators</i>.</u>	• <u>Requires conversion factors for all energy sources.</u> • <u>Conversion factors can be created in multiple ways to achieve different results.</u>	• <u>Requires conversion factors for all energy sources.</u> • <u>Conversion factors can be created in multiple ways to achieve different results.</u>
<u>Treatment of different fuel sources</u>	<u>Typically incentivizes electricity use over fossil fuels or district-energy systems.</u>	<u>Can account for upstream energy losses of different fuel sources, depending on the conversion factor development methodology.</u>	<u>Accounts for carbon impact of different fuel sources directly, allowing direct translation to emissions goals.</u>
<u>Treatment of off-site carbon-free electricity</u>	<u>Off-site carbon-free energy (primarily electricity but could include biogas or other fuel sources) is considered the same as any other grid energy.</u>	<u>Conversion factors can be selected to treat off-site carbon-free electricity as zero, lower impact, or even higher impact compared to other grid electricity.</u>	<u>Off-site carbon-free electricity has zero emissions.</u>