Note: These draft rules for the June 5, 2024 public meeting cover Chapters 1-6 only. Comments may be made at:
Comment on Chapters 1-3: https://odoe.powerappsportals.us/en-US/bps2/
Comment on Chapters 4-6: https://odoe.powerappsportals.us/en-US/bps-5-22-2024/

1. PURPOSE

1.1 This standard establishes *building* ~~*greenhouse gas (GHG) emissions* and~~ energy consumption performance levels for existing *buildings*. This standard provides compliance requirements that will result in improved energy efficiency and reduced *GHG emissions* of existing *buildings*. In adopting this standard, the Oregon Department of Energy seeks to maximize reductions of greenhouse gas emissions from covered commercial buildings.

1.2 This standard is directed toward

a. Setting *performance targets* based on operational ~~*GHG emissions* and~~ energy consumption
b. Accommodating progressively more stringent *performance targets*
c. Providing a technical basis for setting *building performance* standards
d. Providing procedures and programs essential to energy-efficient operation, maintenance, management, and monitoring

2. SCOPE

This standard is mandatory for all covered buildings located in the state of Oregon. This standard applies to existing *buildings*, portions of *buildings*, and *building complexes*, including the envelope and all systems in the *building*. ~~This standard excludes industrial and agricultural processes in *buildings* for which the energy consumption and emissions targets do not include those processes.~~

3. DEFINITIONS

3.1 General. Certain terms, abbreviations, and acronyms are defined in this section for the purposes of this standard. These definitions are applicable to all sections of this standard.

Terms that are not defined herein, but that are defined in standards that are referenced herein, shall have the meanings as defined in those standards.

Other terms that are not defined shall have their ordinarily accepted meanings within the context in which they are used. Ordinarily accepted meanings shall be based on American Standard English language use, as documented in an unabridged dictionary accepted by the *authority having jurisdiction*.

"Agricultural building": a structure that is used for:

(A) Storing, maintaining or repairing farm or forestry machinery and equipment;

(B) Raising, harvesting and selling crops or forest products;

(C) Feeding, breeding, managing and selling livestock, poultry, fur-bearing animals or honeybees or the produce of livestock, poultry, fur-bearing animals or honeybees;

(D) Dairying and selling dairy products; or

(E) Any other agricultural, forestry or horticultural use or animal husbandry, or any combination of agricultural, horticultural or animal husbandry uses, including preparing and storing produce raised on the farm for human use and animal use, preparing, processing and storing agricultural and forestry products and goods and disposing, by marketing or otherwise, of farm produce or forest products.

"Agricultural building" does not include:

(A) A dwelling;

(B) A structure used for a purpose other than growing plants in which 10 or more persons are present at any one time;

(C) A structure regulated by the State Fire Marshal pursuant to ORS chapter 476;

(D) A structure used by the public; or

(E) A structure that is subject to the National Flood Insurance Act of 1968 (42 U.S.C 4001 to 4127), as amended, and regulations promulgated under that Act.

Commented [A1]: Oregon's BPS is based on energy consumption, so references to GHG emissions-based standards have been removed for clarity and to reduce confusion.

Commented [A2]: Part of direction under HB 3409

Commented [A3]: Amendment similar to WA

Commented [A4]: There are exemption pathways for buildings with industrial or agricultural uses. There are not process or end-use specific energy use exclusions for covered buildings.

Commented [A5]: Definition from HB 3409

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analog control: a control loop in which data is expressed or measured by means of one or more physical properties that can express any value along a continuous scale. All types of control systems may provide *analog control*.

Applicable building codes: the building codes of the state of Oregon, as adopted by the Oregon Department of Consumer and Business Services, Building Codes Division

authority having jurisdiction (AHJ): the Oregon Department of Energy ~~the agency or agent responsible for enforcing this standard.~~

baseline: the first-year *energy use intensity* for the *building* at the beginning of the compliance determination process.

benchmarking: the practice of comparing the measured performance of a device, process, facility, or organization to itself, its peers, or established norms, with the goal of informing and motivating performance improvement. When applied to building energy use, benchmarking serves as a mechanism to measure energy performance over time, relative to other similar buildings

building: a structure, including mobile homes, manufactured homes, and other factory-built buildings, wholly or partially enclosed within exterior walls, or within exterior and party walls, and a roof, that affords shelter to persons, animals, or property.

building GHG emissions: *GHG emissions* associated with *building* energy use, calculated from *gross energy* use data using the applicable *GHG emission* conversion factor for each energy form used. The *GHG emission* conversion factors for different fuels, including electricity, are those specified by the Oregon Department of Environmental Quality. Emissions related to electricity use shall be calculated using utility-specific emissions factors for the corresponding year. When emissions factors for the corresponding year are not available, the most recent year available shall be used. ~~include *GHG emissions* associated with the extraction, processing, and transportation of *source 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 an distribution to the *building* site.~~

building manager: the person responsible for maintaining the *building*, its envelope, and its energy-using systems. The *building manager* may also be the person responsible for expending funds on capital improvements to the *building*.

building operator: the person or persons who have responsibility to inspect, operate, and *maintain* the *building* systems and components that fall within the scope of this standard. The *building operator* may be an employee of the *building owner*, the *building manager*, or a contractor.

building owner: the holder of the property title for the *building* and/or the land upon which the *building* sits.

building tenant: a person or entity occupying or holding possession of a building or premises pursuant to a rental agreement.

campus: a collection of *buildings* served by a campus district heating, cooling, water reuse, and/or power system owned by the same *building owner*.

campus district heating and/or cooling system: a *district heating and/or cooling system* that serves a *campus* and is owned by the *building owner*.

building performance: *energy use intensity* (*EUI*) ~~*or greenhouse gas intensity* (*GHGI*).~~

capital management plan: a financial plan to set aside capital to replace or upgrade *building* systems at the end of their useful life and/or to improve *performance* and energy efficiency.

carbon cost: the total cost of the economic damages that would result from emitting one additional unit of carbon dioxide, as quantified by the *AHJ*. Where the *AHJ* has not quantified a *carbon cost*, the cost shall match a value quantified at a national level. (***Informative Note:*** It is recommended that, during adoption, the *AHJ* define a *carbon cost* for the jurisdiction.)

carbon emissions: see *greenhouse gas (GHG) emissions*.

certified commissioning professional: a person who is certified by an ANSI/ISO/IEC 17024:2012 accredited organization to lead, plan, coordinate, and manage commissioning teams and implement the commissioning process, and with

Commented [A6]: Addition similar to WA

Commented [A7]: Addition similar to WA

Commented [A8]: Recommend clarifying the most recently available utility-specific GHG emission conversion factors from DEQ, just in case DEQ also produces state or region-wide emission factors.

Commented [A9]: Reference to state agency emissions factors

Commented [A10]: From WA

experience commissioning at least two projects of similar size and of similar equipment to the current project and at least one in the last three years. This experience includes the writing and execution of verification checks and functional test plans

complex: a group of individual or interconnected *buildings* on contiguous property.

conditional compliance: a temporary method that a building owner can use to demonstrate that the building owner has implemented required energy use reduction strategies when the building owner cannot demonstrate full compliance with a required energy use intensity target or investment criteria. Conditional compliance represents. a compliance level between the completion of implementation in Section 9.1 and verification of compliance in Section 9.2. ~~***Conditional compliance*** expires 15 months following the completion of implementation.~~

Commented [A11]: Modifications to align with HB 3409 and Washington. Conditional compliance timelines/expiration are removed from the definition as they will be addressed in those sections of the standard.

~~***conditioned space:*** a space that is provided with heating and/or cooling capable of maintaining the temperature of the space between 50°F (10°C) and 86°F (30°C).~~

conditioned space: a *cooled space*, *heated space*, or *indirectly conditioned space* defined as follows:

a. ***cooled space:*** an *enclosed space* within a *building* that is cooled by a cooling *system* whose sensible output capacity is ≥3.4 Btu/h·ft2 of *floor* area.

b. ***heated space:*** an *enclosed space* within a *building* that is heated by a heating *system* whose output capacity relative to the *floor* area is greater than or equal to the criteria in Table 3.2.

c. ***indirectly conditioned space:*** an *enclosed space* within a *building* that is not a *heated space* or a *cooled space*, which is heated or cooled indirectly by being connected to adjacent *spaces*, provided

1. the product of the *U-factors* and surface areas of the *space* adjacent to connected *spaces* exceeds the combined sum of the product of the *U-factors* and surface areas of the *space* adjoining the outdoors, *unconditioned spaces*, and to or from *semiheated spaces* (e.g., corridors) or
2. that air from heated or *cooled spaces* is intentionally transferred (naturally or mechanically) into the *space* at a rate exceeding 3 ach (e.g., atria).

Commented [A12]: Definition to align with Oregon Energy Code / ASHRAE 90.1

connected buildings: a collection of *buildings* with shared energy meter(s) on *contiguous property*.

contiguous property: adjoining property under sole ownership

Covered commercial building: a Tier 1 building or a Tier 2 building.

Commented [A13]: Definition from HB 3409

crawl spaces: a shallow, unfinished space beneath the first floor or under the roof of a *building*.

daylight harvesting: the automatic control of electric light levels in response to the amount of daylight in the space.

daylight hours: the period from 30 minutes after sunrise to 30 minutes before sunset.

dimmer: a device that varies the current through an electric light in order to control its level of illumination and energy usage.

direct digital controls (DDC): a control system consisting of microprocessor-based controllers that monitor and control *building* systems equipment through input devices (such as sensors), output devices (such as switches and actuators), and programmed control sequences.

director: the director of the department of commerce or the director's designee.

discounted payback: the time when the accumulated savings achieved by an investment, discounted by the appropriate discount rate, equals the initial cost of the investment. The appropriate discount rate is determined by the *facility owner* to reflect the owner's investment criteria.

district heating and/or cooling system: a system that provides heating or cooling to multiple *buildings* through a distributed system providing steam, hot water, or cool water to *buildings*.

Eligible building owner:

(a) An owner of a tier 1 building that must comply with the standard established in section 9 of this 2023 Act; or

(b) An owner of tier 2 building.

Commented [A14]: Definition from HB 3409

emissions reduction measure (ERM): an action taken in the operation of equipment in the *building* or energy supply to the *building* that reduces the *greenhouse gas (GHG) emissions* of the *building* without negative impact within the *building*. *ERMs* may also be *energy efficiency measures (EEMs*).

Energy:

Commented [A15]: Definition from HB 3409

(a) Electricity, including electricity that is delivered through the electric grid and electricity that is generated at a building site using solar or wind energy resources;

(b) Natural gas;

(c) Steam, hot water or chilled water used for heating or cooling;

(d) Propane;

(e) Fuel oil;

(f) Wood;

(g) Coal; or

(h) Any other fuel that meets a covered commercial building's energy load

energy and emissions accounting system: a system for measuring, collecting, and documenting the *building*'s energy use and its calculated *GHG emissions*.

energy auditor: see *qualified energy auditor*.

energy cost: the total cost for energy supplied to a *building* or *building* site, including such charges as base charges, consumption charges, demand charges, customer charges, power factor charges, and miscellaneous charges such as sales taxes.

energy efficiency measure (EEM): an action taken in the operation of equipment in a *building* that reduces the energy use of the *building* without negative impact within the *building*. *EEMs* may also be *emissions reduction measures* (*ERMs*).

energy manager (EM): the individual, identified by the *building owner*, who has responsibility for ensuring that energy use in the *building* is minimized without compromising the indoor environmental quality (*building* indoor air quality, thermal comfort, visual acuity and comfort, sound quality). The *EM* may be the *building owner*, a tenant, an employee of the owner or tenant, or a contractor retained by the owner or tenant.

energy use intensity (EUI): a measurement that weather normalizes a building's site energy use relative to the building's size, calculated by dividing the total net energy the building consumes in one year by the building's gross floor area, excluding any parking garage, and that is reported in thousands of British thermal units per square foot per year. ~~an expression of *building* energy use per year in terms of *gross energy* divided by gross floor area.~~

EUI target: the *EUI* (of a *building*) that has been established for compliance with this standard.

Greenhouse gas: has the meaning given that term in ORS 468A.210. Greenhouse gas means any gas that contributes to anthropogenic global warming including, but not limited to, carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride.

greenhouse gas (GHG) emissions: a measure used to determine and compare the emissions of various greenhouse gases based on their global warming potential (GWP), including carbon dioxide equivalent (CO_2e) emissions from carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). The CO_2e emissions for a gas are calculated by multiplying the weight of the gas by its associated GWP.

greenhouse gas intensity (GHGI): an expression of *building GHG emissions* per year measured as *building GHG emissions* divided by gross floor area.

~~***GHGI target:*** the *GHGI* (of a *building*) that has been established for compliance with this standard.~~

gross energy: the sum of the metered energy entering the *building* plus the metered energy delivered from active on-site renewable energy minus metered energy leaving the *building* for beneficial use elsewhere; this also applies to portions of *buildings* with submetering. Bulk fuels are included using Equation 5-2 in Section 5.2.2.1.

Gross floor area: the total number of square feet of a building, measured from the exterior surfaces of a building's fixed enclosing walls, including all floor space used as offices, lobbies, restrooms, equipment storage areas, mechanical rooms, break rooms and elevator shafts.

~~***gross floor area for nonresidential buildings:*** the sum of the floor areas of all the spaces within the *building* with no deductions for floor penetrations other than atria. It is measured from the exterior faces of exterior walls or from the centerline of walls separating *buildings*, but it excludes covered~~

Commented [A16]: Potential need to define building "site"

Commented [A17]: Definition from HB 3409

Commented [A18]: Definition from HB 3409 and other Oregon statute, reproduced here for clarity.

Commented [A19]: Definition from HB 3409

Commented [A20]: Definition from HB 3409

Commented [A21]: Oregon targets are based on site energy use, so GHGI targets are not applicable.

Commented [A22]: Remove ASHRAE 100 components of definition, similar to Washington and to be consistent with HB 3409, align with Energy Star Portfolio Manager and Washington State Guidelines.

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~~walkways, open roofed over areas, porches and similar spaces, pipe trenches, exterior terraces or steps, roof overhangs, parking garages, surface parking, and similar features.~~

~~***gross floor area for residential buildings:*** the sum of the floor areas of all the conditioned (heated and/or cooled) spaces within the *building*, including conditioned garages, conditioned basements, and conditioned attics. It is measured from the exterior faces of exterior walls or from the centerline of walls separating *buildings*. It excludes *crawl spaces*, covered walkways, open roofed over areas, porches and similar spaces, exterior terraces or steps, and roof overhangs.~~

"Gross floor area" does not include bays or docks outside the building, exterior spaces, covered walk-ways, open roofed-over areas, outdoor play courts, porches, exterior terraces or steps, roof over-hangs, balconies, decks, patios, pipe trenches, interstitial plenum space between floors (which houses pipes and ventilation, driveways, parking garages, or surface park-ing.

high-efficacy lamps: *lamps* with a minimum efficacy of 60 lm/W for *lamps* over 40 W, 50 lm/W for *lamps* over 15 to 40 W, or 40 lm/W for *lamps* 15 W or less.

HVAC system: the equipment, distribution systems, and terminals that provide the processes of heating, ventilating, or air conditioning to a *building* or portion of a *building*.

industrial process: a systematic series of mechanical or chemical operations that produce or manufacture something.

interactive effect: the change in resultant energy-savings estimates or actual energy savings due to analyzing or implementing multiple *EEMs* that interact with one another.

internal rate of return (IRR): the discount rate in a capital project that makes the net present value of all cash flows from a particular project equal to zero. The higher a project's *IRR*, the more desirable it is to undertake the project. *IRR* can be used to rank several prospective projects under consideration. *IRR* is defined by the following equation:

$$0 = \sum_{t=1}^{n} \frac{CF_t}{(1 + IRR)^t} - CF_0$$

where

n = the useful life of the measure in years
CF_t = the annual cost savings of the measure in year t (cash flow in year t)
CF_0 = the initial cost of the measure (cash flow initial)

lamp: a replaceable component of a *luminaire*, such as an incandescent light bulb, that is designed to produce light from electricity.

lighting schedule: a list that provides a count of all *luminaires* in the *building*, their *lamps*, lighting controls, fixture types, and product information.

lighting power density: the lighting power per unit area of a *building* or a space in a *building*.

luminaire: a complete lighting unit consisting of a *lamp* or *lamps* (and ballasts and/or drivers when applicable) together with the housing designed to distribute the light, position and protect the *lamps*, and connect the *lamps* to the power supply.

maintain: the process of keeping equipment and components operating or functioning in accordance with manufacturers' recommendations and industry standards over their service lives. It involves but is not limited to carrying out observation, lubrication, adjustment, calibration, testing, cleaning, replacement, and repair at appropriate intervals as applicable to the specific equipment or component.

more recently built buildings: *buildings* or additions greater than 35,000 square feet in conditioned floor area permitted for construction based on the application permit date of October 1, 2019, or later. For example, *buildings* permitted to the 2019 edition of the Oregon energy code (known as the 2019 Oregon Zero Energy Ready Commercial Code).

Commented [A23]: Added similar to WA.

motion sensor: an *occupancy sensor* used for exterior areas.

multiscene control: a lighting control device or system that allows for two or more predefined lighting settings, in addition to an all-off setting, for two or more groups of *luminaires* to suit multiple activities in the space, and allows the automatic recall of these settings.

Net energy use: the sum of metered and bulk fuel energy that enters a building, minus the sum of metered energy that leaves the building.

Commented [A24]: Definition from HB 3409

nighttime hours: the period from 30 minutes before sunset to 30 minutes after sunrise.

nonrenewable energy: energy other than renewable energy or *recovered energy*.

nonresidential building: as used in this standard, any *building* that does not match one of the types of *residential buildings* listed in the Table 7-1.

occupancy sensor: a device that detects the presence or absence of people within an area and causes lighting, equipment, or appliances to be regulated accordingly.

optimized bundle of EEMs: a collection of *EEMs* that maximizes the energy savings at a facility within the cost-effectiveness criteria of the standard. It excludes any measure with a *simple payback* that exceeds the life of the measure. A bundle of measures is optimized by including the maximum number of *EEMs* within the bundle while still meeting the cost-effectiveness criteria. The process for determining the *optimized bundle of EEMs* may be an iterative one due to *interactive effects* of individual *EEMs*.

optimized bundle of ERMs: a collection of *ERMs* (including the *optimized bundle of EEMs*) that maximizes the *GHG emissions* reduction at a facility within the cost-effectiveness criteria of this standard. It excludes any measure with a *simple payback* that exceeds the life of the measure. A bundle of measures is optimized by including the *ERMs* with the largest total *GHG emissions* reduction within the bundle while still meeting the cost-effectiveness criteria. The process for determining the *optimized bundle of ERMs* may be an iterative one due to *interactive effects* of individual *ERMs*.

performance: manner in which an individual, a *building*, a system, or a component fulfills specified behavior.

performance target: the *EUI target* ~~*or GHGI target*~~ for a *building* that has been established for compliance with this standard.

photosensor: a device that detects the presence of and/or measures the amount of visible light, infrared (IR) transmission, and/or ultraviolet energy, and emits a signal based on the presence, absence, and/or amount of these entities.

physical occupancy: space that is used by an owner or tenant regardless of occupant density and frequency of use. A *building* does not have *physical occupancy* and is considered unoccupied when 50% or more of

Commented [A25]: Added similar to WA

the conditioned floor area is not leased or is otherwise vacant.

primary energy: see *source energy*.

qualified energy auditor: a person having training and expertise in *building* energy auditing. A *qualified energy auditor* is any of the following:

a. A licensed professional architect or engineer in the state of Oregon ~~jurisdiction where the project is located~~
b. A Building Energy Assessment Professional (BEAP) certified by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
~~b.~~c. A Certified Energy Auditor (CEA) certified by the Association of Energy Engineer ~~An *energy auditor/assessor/analyst certified by ASHRAE or AEE for all building types, or certified by BPI or RESnet for residential buildings*~~
~~c. A person qualified by the *AHJ*~~

qualified energy manager (QEM): an individual designated by the *building owner* who:

a. Has two years of experience, including educational and/or professional experience, with commercial building operations and/or building energy management in addition to successful completion of training as specified by the AHJ, or
b. Meets the definition of a qualified person

qualified person: a person having training and expertise in *building* energy use analysis. A *qualified person* is any of the following:

a. A licensed professional architect or engineer in the state of Oregon ~~or licensed contractor in the jurisdiction where the project is located~~
b. A ~~certified~~ *qualified energy auditor* or
~~b.~~c. ~~*energy manager*~~A Certified Energy Manager (CEM) in current standing, certified by the Association of Energy Engineers
~~c. A person qualified by the *AHJ*~~
d. A person with Building Operator Certification (BOC) Level II by the Northwest Energy Efficiency Council (NEEC)
e. A building commissioning professional certified by an ANSI/ISO/IEC 17024:2012 accredited organization
f. An energy management professional (EMP) certified by the Energy Management Association (EMA)
g. A person with Lane Community College Energy Management with Building Controls program degree, or as approved as equivalent by the AHJ
h.

The AHJ may prescribe additional certifications and training to meet the minimum qualifications of a qualified person. When the AHJ prescribes such additional qualifications, it will provide notice of the determination on the agency website and will periodically update these rules to reflect additional qualifications of qualified persons.

recommissioning: an application of the commission process requirements to a project that has been delivered using the commissioning process

recovered energy: energy reclaimed for useful purposes that would otherwise be wasted.

residential building: for the purposes of this standard, any *building* matching one of the descriptions for *building* types 49 through 53 in Table 7-1.

Savings to investment ratio: the ratio of the total present value of savings to the total present value of costs to implement an energy conservation measure or water conservation measure, in which the numerator of the ratio is the present value of net savings in energy or water or in maintenance costs not related to fuel use or water use that are attributable to the energy conservation measure or water conservation measure and the denominator of the ratio is the present value of the net increase in investment and replacement costs, less the salvage value, of the energy conservation or water conservation measure.

Semiheated space: an enclosed space within a covered commercial building that is heated by a heating system with an output the Department of Consumer and Business Services specifies in an applicable

Commented [A26]: Oregon is the applicable jurisdiction

Commented [A27]: Specification that ASHRAE BEAP and AEE CEA certifications are acceptable for qualified energy auditors. This is similar to WA. Interested in comments if there should be others.

Commented [A28]: These modifications are similar to WA. Interested in comments if there should be others.

Commented [A29]: Definition from HB 3409

Commented [A30]: Definition from HB 3409

specialty code.

service log: a document in which service and maintenance work performed for a given piece of equipment is recorded, and that contains a date, the service technician's name, and a description of work performed.

simple payback (years): the estimated initial cost of an *EEM* divided by the estimated annual cost savings of the measure expressed in years. The cost savings may include *energy cost* savings and incremental routine operations and maintenance costs.

site: a building, portion of a building, or group of buildings, and surrounding area of land inside the boundary that is contiguous or separated only by public rights-of-way, all of which are under the same ownership or control.

Commented [A31]: Added definition of "site" from ASHRAE 228

site energy: energy consumed by a *building* as measured at the boundaries of the *building* site.

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*.

state equipment standards: appliance and equipment standards listed in Oregon Administrative Rule Chapter 330, Division 92.

Tier 1 building: a building in which the sum of gross floor area for hotel, motel and nonresidential use equals or exceeds 35,000 square feet, excluding any parking garage.

Commented [A32]: Definition from HB 3409

Tier 2 building:

(A) A building with gross floor area, excluding any parking garage, that equals or exceeds 35,000 square feet and that is used as a multifamily residential building, a hospital, a school, a dormitory or a university building; or

(B) A building in which the sum of gross floor area for hotel, motel and nonresidential use exceeds 20,000 square feet but does not exceed 35,000 square feet, excluding any parking garage.

"Tier 2 building" does not include a covered commercial building that is classified as a Tier 1 building.

Unconditioned space: an enclosed space within a covered commercial building that is not:

Commented [A33]: Definition from HB 3409

(a) Heated by a heating system or cooled by a cooling system with output capacities the Department of Consumer and Business Services specifies in an applicable specialty code; or

(b) Indirectly heated or cooled in accordance with standards the department specifies in an applicable specialty code.

useful life: useful life is the expected remaining service life of building systems or equipment. Used interchangeably with service life.

Weather normalized: a method for modifying a building's energy use intensity in a specific year to account for deviations from the building's energy use intensity as the energy use intensity ordinarily occurs during a year in which the weather does not fluctuate substantially or vary as a consequence of extreme weather events.

Commented [A34]: Definition from HB 3409

X

zone: a space or group of spaces within a *building* for which the heating, cooling, or lighting requirements are sufficiently similar that desired conditions can be maintained throughout by a single controlling device.

3.2 Abbreviations and Acronyms *AHJ*

authority having jurisdiction

ASE annual sunlight exposure

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ASH	antisweat heating
CAV	constant air vol-
ume	
CO_2e	carbon dioxide equivalent
DDC	*direct digital control*s DOAS
	dedicated outdoor air sys-
tem DX	direct expansion
EEM	*energy efficiency meas-*
ure EM	*energy manager*
ERM	*emissions reduction meas-*
ure EUI	*energy use intensity*
EUI_t	*energy use intensity target*
FDD	fault detection and diagno-
sis GHG	greenhouse gas
GHGI	*greenhouse gas intensity*
$GHGI_t$	*greenhouse gas intensity tar-*
get GWP	global warming potential
HID	high-intensity discharge
IRR	*internal rate of return*
JSM	jurisdiction-specific methodology
LCC	life-cycle costing
O&M	operations and maintenance
sDA	spatial daylight autonomy
SEER	seasonal energy efficiency ratio
VAV	variable air volume
VFD	variable-frequency drive
VSD	variable-speed drive

4. COMPLIANCE REQUIREMENTS

4.1 Compliance Forms. Forms for recording information used for demonstrating compliance with standard are located in Normative Appendix A. Submittal to the authority having jurisdiction, AHJ, will be done electronically in a manner specified by the AHJ.

4.2 Building Type Requirements

4.2.1 ~~Nonresidential Building~~Tier 1 Buildings

4.2.1.1 A *building* or *complex* of *buildings* whose majority of gross floor area has activities ~~number 1 through 50 and/or 55~~ in Table 7-1 has ~~*performance targets* and~~ shall comply with the requirements of Sections 4.3, 4.4~~.1, and 4.4.2.~~, and 4.5.

4.2.1.2 For Tier 1 buildings, ~~T~~the *qualified person* determining compliance shall

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

~~**4.2.2 Residential Building**~~

~~**4.2.2.1** A *building* with activities number 49 through 52 in Table 7-1 shall comply with the requirements~~

Commented [A35]: ASHRAE Standard 100 includes sample forms for demonstrating compliance. The program will involve reporting via a software platform that has not yet been specified. We do not plan to collect paper forms. This Appendix (which is similar to Washington Annex Z) will be covered in a future meeting.

Commented [A36]: Standard 100 includes a pathway for individual tenant compliance, but Oregon's BPS is based on whole buildings.

Commented [A37]: This is covered in item c. in this section

Commented [A38]: Standard 100 has a pathway for residential buildings. Residential Multifamily are Tier 2 and not included in Oregon's BPS requirements.

~~of Section 10.~~

~~**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, C-2, and C-3 to the *AHJ*.~~

~~**4.2.3 Buildings with Residential and Nonresidential Activities**~~

~~**4.2.3.1** Individual dwelling units in a multitenant *building* seeking compliance apart from the *building* shall comply with Section 10.~~

~~**4.2.3.2** The *qualified person* determining compliance for *buildings* with both residential and nonresidential activities shall comply with Section 4.2.1.2.~~

4.3 Energy and Emissions Management Plan and Operations and Maintenance Program

4.3.1 Operations and Maintenance. The *building manager* shall comply with the operations and maintenance (O&M) requirements of Section 6. The *qualified person* determining compliance shall state in writing ~~on Form A~~in a manner specified by the AHJ that the O&M requirements of Section 6 have been met according to the following subsections.

4.3.1.1 For first-time applicants, for the previous year.

4.3.1.2 For previously compliant *buildings*, since the previous validation of compliance.

4.3.2 Energy and Emissions Management Plan. The *building manager* shall comply with the energy management requirements of Section 5. The *qualified person* determining compliance shall state in writing ~~on Form A~~ that the energy and emissions management program described in Section 5 has been developed and is being maintained ~~as of the date on Form A~~.

4.4 Building Performance

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 or using similar software or calculations, ~~C-2, and C-3~~ according to Section 5.2.

4.4.2 Buildings with Performance Targets

4.4.2.1 Compliance Process. Tier 1 *Buildings* with *performance targets* shall comply with the requirements of Sections 4.4.2.2 and 4.4.2.3. Figure 4-1 illustrates the compliance process for Tier 1 *buildings* with *performance targets*.

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.

4.4.2.3 Building Does not Meet the Performance Targets. If ~~either~~ the *building*'s measured *EUI* is greater than the *EUI target* ~~or the *building*'s measured *GHGI* is greater than the *GHGI target*,~~ then an energy audit with decarbonization assessment shall be performed. A *qualified energy auditor* shall complete an energy audit according to Section 8. *EEMs* ~~and *ERMs*~~ that will reduce energy use ~~and *GHG emissions*~~ to meet the *EUI target* ~~and *GHGI target*~~ shall be implemented according to Section 9. Upon completion of the implementation of all required *EEMs* to meet the EUI target ~~and *ERMs*~~, a *building* shall be granted *conditional compliance*.

Exception to 4.4.2.3:

No individual requirement need be met that would compromise the historical integrity of a *building* or part of a *building* designated by a government body for long-term preservation in its existing state, such as historical monuments.

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 A 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 suspended until either

a. Additional *EEMs* ~~and *ERMs*~~ have been implemented that reduce the subsequently measured *EUI* ~~and~~

Commented [A39]: Removed requirements to calculate GHG intensity, as the BPS is based on site energy

Commented [A40]: Forms C-2 and C-3 are for source energy and GHG intensity, respectively, and are not necessary for Oregon.

Commented [A41]: WA requires "more recently built buildings" to meet a target that is 15% more efficient than other buildings. This is not currently proposed for Oregon due to differences in nature between EUI targets and desire for target consistency.

~~*GHGI*~~ to less than or equal to the *EUI target* ~~and *GHGI target*~~, respectively, and a new Form A is submitted to the *AHJ* or

b. The *AHJ* revokes *conditional compliance*

4.4.3 Buildings without Performance Targets

4.4.3.1 Compliance Process. *Buildings* without *performance targets* shall comply with the requirements of Sections 4.4.3.2 and 4.4.3.3. Figure 4-2 illustrates the compliance process for *buildings* without *performance targets*.

4.4.3.2 A *qualified energy auditor* shall conduct an energy audit with decarbonization assessment according to Section 8, and the *optimized bundle* of ~~*ERMs*~~ *EEMs* shall be identified according to Section 9.1.1.2.

4.4.3.3 Implement Energy Efficiency Measures and Emissions Reduction Measures. The entire *optimized bundle* of ~~*ERMs*~~ *EEMs* shall be implemented. Upon completion of the implementation of the *optimized bundle* of ~~*ERMs*~~*EEMs*, a *building* shall be granted *conditional compliance* in accordance with Section 9.1.1.2.

Exception to 4.4.3.3: No individual requirement need be met that would compromise the historical integrity of a *building* or part of a *building* designated by a government body for long-term preservation in its existing state, such aevs historical monuments.

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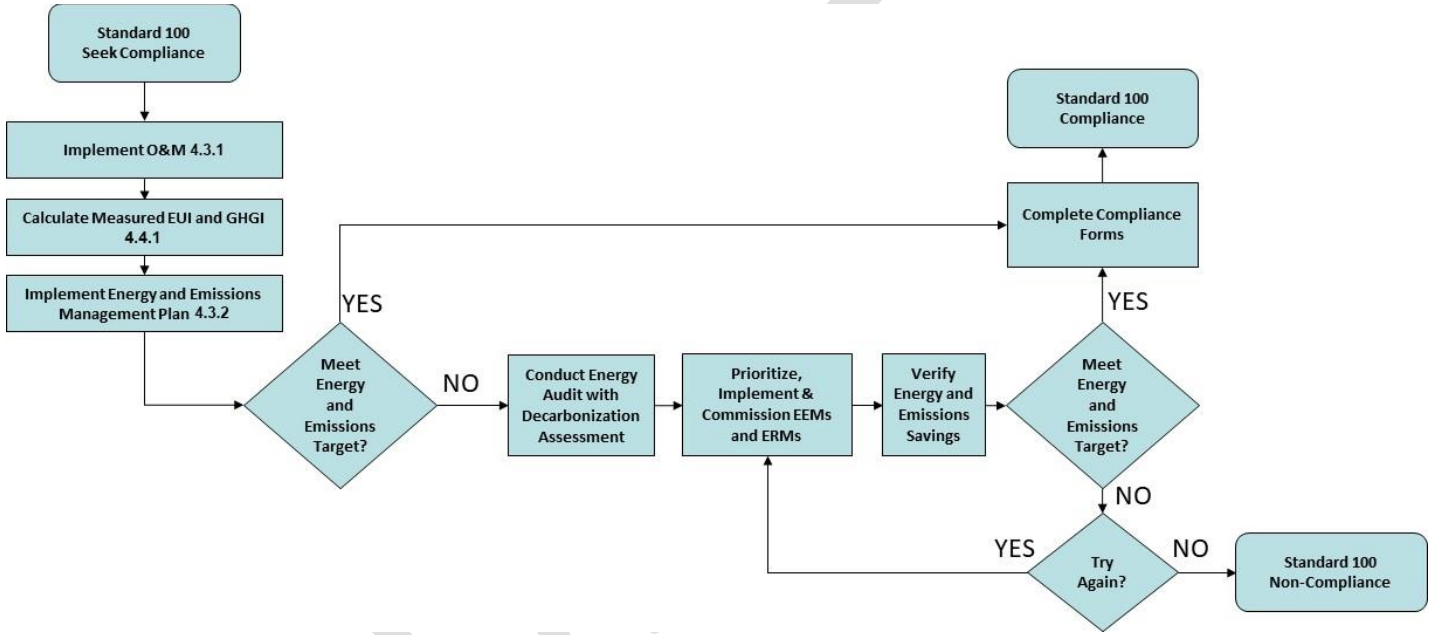

Figure 4-1 Flowchart for buildings with performance targets.

Note: These draft rules for the June 5, 2024 public meeting cover Chapters 1-6 only. Comments may be made at:
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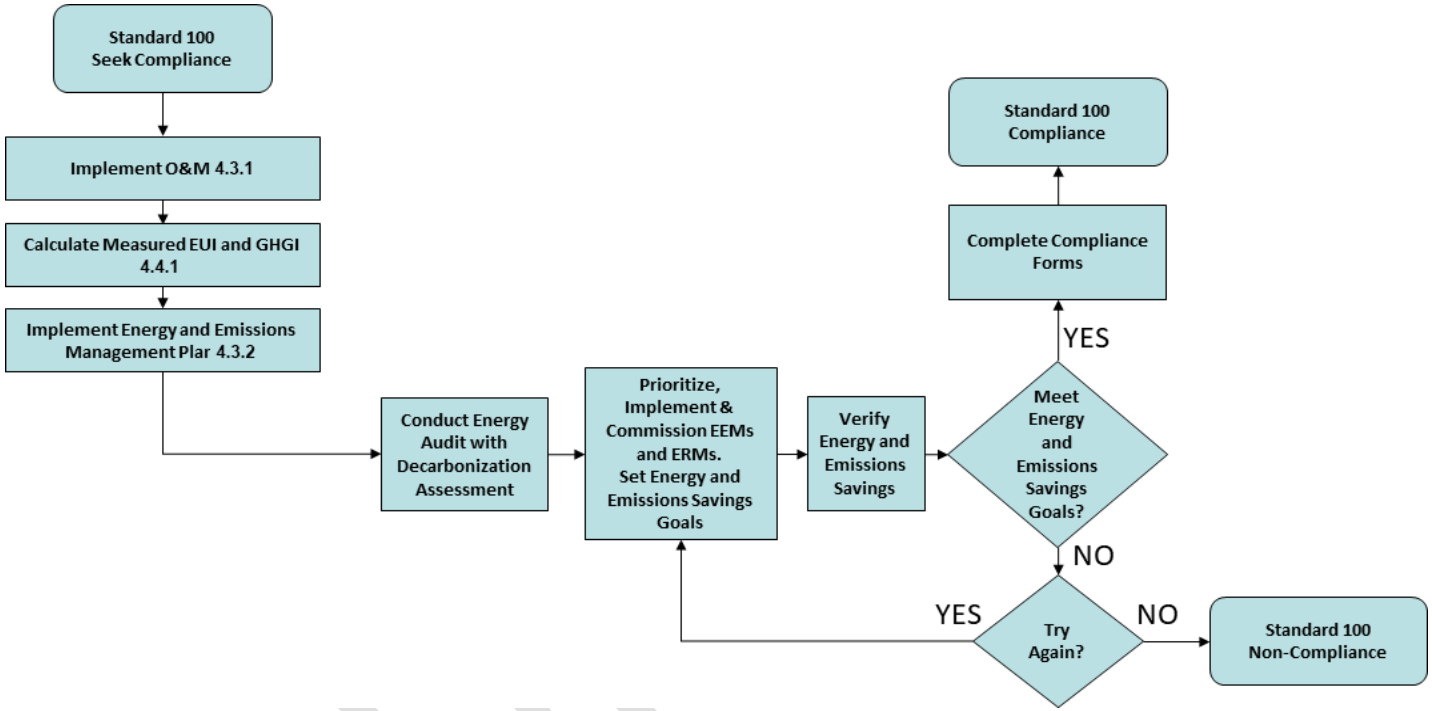

Figure 4-2 Flowchart for buildings without performance targets.

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4.4.3.4 Verification of Compliance for Buildings with Building Energy Monitoring in Compliance with Section 5.2. If the *building* complies with Section 4.3, then within 15 months following the completion of implementation of the *optimized bundle* of ~~*ERMs*~~*EEMs*, *building owners* with *conditional compliance* or the *qualified person* representing the *building owner* shall submit verification that measured postimplementation energy savings ~~and *GHG emissions* reduction~~ meet or exceed 75% of the energy savings ~~and *GHG emissions* reduction~~ projected in the energy audit with decarbonization assessment report to the *AHJ*. Energy savings ~~and *GHG emissions* reduction~~ shall be compared at the whole-*building* consumption level in common units for electricity, fossil fuels, and other sources. If the measured postimplementation energy savings ~~and *GHG emissions* reduction~~ of the *optimized bundle of* ~~*ERMs*~~ *EEMs* do not meet or exceed 75% of the energy savings ~~and *GHG emissions* reduction~~ projected in the energy audit with decarbonization assessment, the *conditional compliance* is suspended until either

a. Additional *EEMs* ~~and/or *ERMs*~~ are implemented that reduce the subsequently measured energy savings ~~and/or *GHG emissions* reduction~~ of the *optimized bundle of* ~~*ERMs*~~ *EEMs* so that it meets or exceeds 75% ~~and *GHG emissions* reduction~~ of the energy savings projected in the energy audit with decarbonization assessment; or

~~a.~~b. Verification of energy savings using the methods of the *International Performance Measurement & Verification Protocol, Concepts and Options for Determining Energy and Water Savings Volume I*, Options A through D. If the measurement and verification protocol identified any outstanding performance issues, they shall be corrected and the verification protocol shall be repeated to ensure optimal performance; or

c. The *AHJ* revokes *conditional compliance*

~~b.~~**4.4.3.5 Verification of Compliance for Buildings without Building Energy Monitoring in Compliance with Section 5.2.** Verification of energy savings using the methods of the International Performance Measurement & Verification Protocol, Concepts and Options for Determining Energy and Water Savings, Volume I, Options A through D. If the measurement and verification protocol identified any outstanding performance issues, they shall be corrected and the verification protocol shall be repeated to ensure savings estimated in the original audit are realized.

4.5 General

4.5.1 Administrative Requirements. *Building owners* shall demonstrate compliance with the standard by following the administrative requirements in Normative Appendix AAA for *Tier 1 covered buildings*. ~~Administrative requirements relating to permits; enforcement by the *AHJ*; locally adopted energy standards, including energy *performance targets*; interpretations; claims of exemption; and rights of appeal are specified by the *AHJ*.~~

~~**4.5.2 Alternative Energy Use Intensity Targets.** The *qualified person* determining compliance shall demonstrate to the *AHJ* that they have met the required *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*.~~

5. ENERGY AND EMISSIONS MANAGEMENT PLAN

5.1 Establish the Energy and Emissions Management Plan

5.1.1 The *building owner* shall designate an *energy manager* (*EM*) to develop and *maintain* an energy and emissions management plan for the *building*. The emissions portion of the plan shall consider *greenhouse gas* (*GHG*) *emissions* associated with the *building*'s energy consumption.

~~**Exception to 5.1.1:** *Buildings* smaller than 5000 ft² (465 m²) are not required to have an *EM* or an energy and emissions management plan.~~

5.1.2 The energy and emissions management plan shall incorporate the following.

5.1.2.1 An *energy and emissions accounting system* to record the energy use and *GHG emissions* in accordance with Section 5.2.

Commented [A42]: Similar pathway to WA for verifying compliance for buildings with building energy monitoring to determine energy improvement

Commented [A43]: ERMs are "Emissions Reduction Measures", not applicable to energy-based BPS. The focus is on EEMs.

Commented [A44]: Pathway similar to WA to verify compliance for buildings without building energy monitoring.

Commented [A45]: Similar language to the process in Washington, where the specific methods for demonstrating compliance are included in an appendix. This is Appendix Z for Washington, but specific label is TBD for Oregon. We will cover this appendix at a later meeting.

Commented [A46]: This size of building will not be covered by Oregon's BPS.

Commented [A47]: Note that this section 5.1.2 includes items that "shall" be part of the energy and emissions plan.

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5.1.2.2 In the initial year of compliance, the *building*'s *energy use intensity* (*EUI*) ~~and *greenhouse gas intensity* (*GHGI*)~~.

5.1.2.3 Annual updates of the ~~*gross*~~*net energy* use and~~,~~ *EUI*~~, and *GHGI*~~.

5.1.2.4 For *buildings* with *performance targets*, annual comparison of the *building*'s *EUI* to its *EUI target* ~~and comparison of the *building*'s *GHGI* to its *GHGI target*~~.

5.1.2.5 For *buildings* without *performance targets*, annual comparison of the *building*'s *EUI* ~~and *GHGI*~~ to the adjusted *EUI* ~~and adjusted *GHGI*~~ established by its most recent energy audit with decarbonization assessment. (Refer to detailed requirements in Sections 8 and 9.)

5.1.2.6 Documentation of original, current, and changes in number of occupants, weekly operating hours, or time of day scheduled for occupancy, ~~production rates~~, and energy-using equipment that would have caused change in the measured *EUI* ~~or *GHGI*~~.

5.1.2.7 Energy audit with decarbonization assessment reports if required based on section 4.4.2 ~~if applicable~~ and recommended *energy efficiency measures* (*EEMs*) from those audits ~~and *emission reduction measures* (*ERMs*)~~. (Refer to Section 8.)

~~**5.1.2.7**~~**5.1.2.8** Contact information for serving utilities and programs that may offer incentives for energy efficiency measures.

~~**5.1.2.8**~~**5.1.2.9** A list of *EEMs* ~~and *ERMs*~~ that have been implemented and dates of implementation, including the following:

a. An operations and maintenance (O&M) program as defined in Section 6 for the *EEMs* ~~and *ERMs*~~
b. An implementation plan for *EEMs* ~~and *ERMs*~~, including commissioning
c. Staff training plan for *EEMs* ~~and *ERMs*~~
d. Ongoing commissioning plans for the *EEMs* ~~and *ERMs*~~

5.1.3 The energy and emissions plan may also incorporate, but is not limited to, the following:

5.1.3.1 A method to inform occupants about the benefits of efficient energy use, and to instruct them in the use and adjustment of operable windows, *HVAC system* controls, and lighting system components and controls. This shall include materials (electronic or printed) as appropriate.

5.1.3.2 A training plan for the O&M personnel to operate the *building* systems to achieve established indoor environmental targets with optimum energy efficiency.

5.1.3.3 A *capital management plan* identifying the following:

a. *EEMs* ~~and *ERMs*~~ not selected for implementation that were designated as future opportunities in Section 9
b. Equipment and systems for replacement in case of failure that will result in the maximum reduction in energy use and *GHG emissions* consistent with reasonable financial *performance*, including ENERGY STAR® rated equipment

   Exception to (b): Equipment intended for standby or emergency use only.
c. Estimated end of useful life for envelope, lighting, space heating and cooling, and water heating systems
d. Sizing calculations for the replacement of heating and cooling equipment based on the *building* as modified by the *EEMs* identified in Section 5.1.2.7
e. Opportunities for addition of updated system controls and demand response integration
f. Restrictions on the use and application of electric resistance heat for space and water heating
g. Recommendations on use of dual-fuel systems to ease *building* transition off fossil fuel
h. A phase-out plan for all on-site fossil-fuel combustion equipment and systems

   Exception to (h): Equipment intended for standby or emergency use only.
i. Plan for fuel-gas pipe testing every five years and at the time of installation of new or replacement combustion equipment
j. Opportunities for installation of on-site renewable energy

5.1.3.4 A contact list of suppliers and manufacturers' local representatives of energy efficient equipment, low *GHG* equipment, qualified installers, *qualified energy auditors*, the *EM*, and the *building owner*.

5.1.3.5 The current *lighting schedule* and the calculated *lighting power density* along with the

Commented [A48]: ASHRAE references "gross" energy use for all energy measurements, but Oregon will need to reference "net" energy

Commented [A49]: Note that this section 5.1.3 includes items that "may" be (but would not necessarily be required to be) part of the energy and emissions management plan.

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potential savings from any potential *EEMs*.

Exceptions to 5.1.2.13:

1. *Buildings* that meet the *EUIt*.
2. *Buildings* that have implemented a utility program lighting upgrade covering 75% of the ~~**5.1.3.5**~~ *building*'s GFA, within the previous five years, can use the *lighting schedule* provided by the utility program.

5.1.3.6 The current lighting satisfaction survey and lighting checklist as described in *Performance Measurement Protocols for Commercial Buildings* [1], Appendix D.

Exceptions to 5.1.2.14:

1. *Buildings* that meet the *EUIt*.
2. *Buildings* that have implemented a utility program lighting upgrade covering 75% of the *building*'s GFA, within the previous five years.

~~**5.1.3.6**~~

5.1.4 The *EM* shall provide notification and access to a copy of the energy and emissions management plan to the *building* occupants and other stakeholders annually.

5.1.5 The *building owner* shall review and sign the energy and emissions management plan annually.

5.2 Building Energy ~~and Emissions~~ Monitoring. *Building ~~gross~~ net energy* use ~~and *GHG emissions*~~ shall be monitored and recorded in accordance with following sections.

5.2.1 Provide measured ~~*gross*~~ *net energy* consumption data for each *building*, including all forms of imported energy~~,~~ and exported energy~~, 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*~~ *net energy* concept is illustrated in Figure 5-1 and is calculated in accordance with Section 5.2.4. A *building*'s *net*~~*gross*~~ *energy* use *is illustrated in Figure 5-1 and Table 5-1 and* shall be calculated using Equation 5-1:

~~*Gross*~~ *Net energy* use =

Metered and bulk fuel ~~E~~energy that enters ~~delivered to the~~ a *building* ~~+ On-site renewable energy produced and delivered to the *building* – Excess energy exported from *building* for beneficial use~~Metered energy that leaves the building

Net energy use = (1a + 1b + 1c + 1d) – (3a + 3b + 3c + 3d + 3e) (5-1)

where 1a, 1b, 1c, and 1d are metered energy supplies that are used in the *building* (this includes bulk energy sources), and 3a, 3b, 3c, 3d, and 3e are metered energy excesses that are supplied to another *building* or grid as useful energy.

5.2.1.1 Connected Buildings. Where energy consumption is not monitored at the covered building level,

1. Tier 1 covered buildings: net energy consumption data may be provided at the connected building level.
2. Tier 2 covered buildings: net energy consumption data shall be provided at the connected building level.

5.2.1.2 End Use Deductions. Where submetered from a building's meter, the following end use energy consumption may be deducted from the building's measured net energy use,

1. Electric vehicle charging equipment that transfers electricity to batteries or other energy storage devices in electric vehicles.
2. Electric loads related to broadcast antennas, onsite cell phone towers or other communications equipment that is unrelated to the primary purpose of the building
3. The AHJ may add additional end use deductions based on technological advancements.

Informative Notes:

1. As shown in Figure 5-1, a *building*'s ~~*gross*~~ *net 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:

Commented [A50]: These exceptions are similar to WA

Commented [A51]: Modifications to this section are to incorporate "net" energy use and remove equations and references for "gross" energy.

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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*

~~b.~~c. *On-site renewable energy generation that is delivered to the electric grid and is not used by the building.*

5.2.2 Energy use data for each type of energy imported into and exported from the *building* shall be collected from utility or energy delivery bills (that must include the quantity of energy or fuel delivered) or by monitoring local energy meters (either utility or owner provided). If the exported energy cannot be measured, it shall be estimated using a methodology that is acceptable to the *AHJ*.

Commented [A52]: This language could allow for a means for "subtracting" out electricity related to transportation (EV-charging) through estimation, where it is not directly metered.

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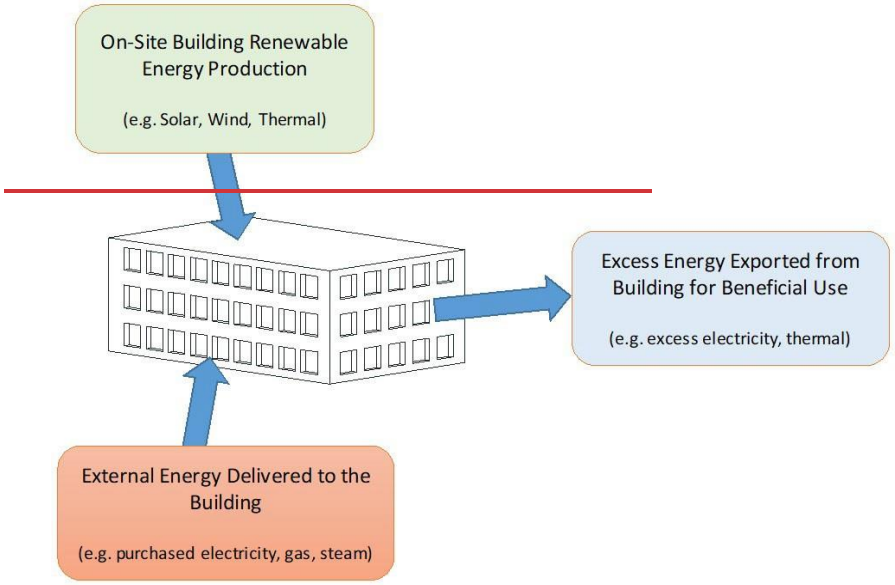

Commented [A53]: Note: this graphic from ASHRAE 100-2024 needs to be modified to remove the onsite building renewable energy input. For the Oregon BPS, it will be "net energy" and on-site generation used at the building wouldn't "penalize" and increase a building's EUI. Proposed graphic and table from ASHRAE 100-2018 (that focused on net energy) is included.

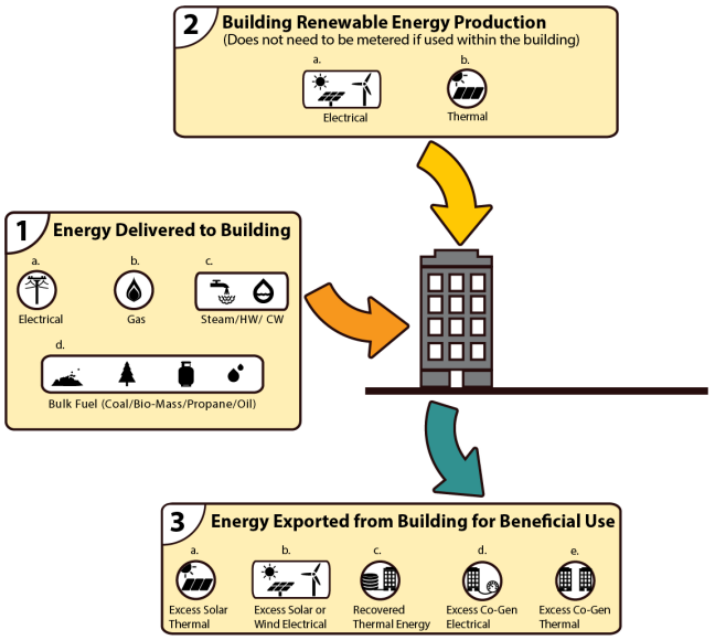

Figure 5-1 ***Net energy*** **concept.**

Figure 5-1 ~~Gross~~ Net energy concept.

Note: These draft rules for the June 5, 2024 public meeting cover Chapters 1-6 only. Comments may be made at:
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Table 5-1 Energy Flow Definitions

Energy Delivered to Building	Building Renewable Energy Production	Energy Exported from Building for Beneficial Use
1a. Electrical	2a. Electrical	3a. Excess solar thermal
1b. Gas	2b. Thermal	3b. Excess solar or wind electrical
1c. Steam/hot-water (HW)/chilled and hot water (CHW)		3c. Recovered thermal energy
1d. Bulk fuel (coal/biomass/propane/oil)		3d. Excess co-gen electrical
		3e. Excess co-gen thermal

Table 5-1 Energy Flow Definitions

5.2.2.1 When an energy type such as oil, solid fuels, or biomass is delivered in bulk to the *building* for storage prior to actual use, the annual energy use for that energy type shall be calculated using Equation 5-2:

$$\text{Annual bulk energy use} = A + B - C \quad (5\text{-}2)$$

where

A = measured inventory of the energy type at the beginning of the 12-month period, converted to energy equivalent (Refer to Section 5.2.3.)

B = amount of the energy type delivered to the *building* during the 12-month period, converted to energy equivalent (Refer to Section 5.2.3.)

C = measured inventory of the energy type at the end of the 12-month period, converted to energy equivalent (Refer to Section 5.2.3.)

5.2.2.2 If the annual energy consumption of an inventoried energy type is less than twice its on-site storage capacity, the inventory measurement accuracy and methodology shall be reported as part of the *energy ~~and emissions~~ accounting system* documentation.

5.2.3 Site Energy~~, Source Energy, and Greenhouse Gas Emissions~~ Calculation. ~~*Gross*~~ *Net energy* shall be converted to *site energy~~, source energy, and GHG emissions~~* according to Sections 5.2.3.1 ~~through 5.2.3.3.~~

~~***Informative Note:*** Forms C-1, C-2, and C-3 can be used to calculate *site energy, source energy, GHG emissions,* site *EUI,* source *EUI,* and *GHGI.*~~

5.2.3.1 Site Energy. *Site energy* shall be calculated by converting the amount of each form of purchased energy from the purchased unit to the standard *site energy* unit using the conversion factors incorporated into Energy Star Portfolio Manager. ~~If *site energy* conversion factors are not provided by the utility or fuel supplier, the conversion factors in Table 5-1 shall be used. (See also Informative Appendix K.)~~

Commented [A54]: Since Portfolio Manager will be used for reporting, refer to the conversion factors in that program to eliminate any possibility for discrepancies (although any discrepancies would be minor)

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

~~$$\textit{Source energy} = \textit{Site energy}_1 \times SEF_1 + \ldots + \textit{Site energy}_i \times SEF_i + \ldots + \textit{Site energy}_n \times SEF_n \quad (5\text{-}3)$$~~

~~where~~

~~$\textit{Site energy}_i$ = *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*~~

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Table 5-1 Site Energy Conversion Factors

~~Fuel Oils~~	~~kJ/L~~	~~Btu/U.S. gal~~
~~#1~~	~~37,600~~	~~135,000~~
~~#2~~	~~38,700~~	~~139,000~~
~~#4~~	~~40,700~~	~~146,000~~
~~#5L~~	~~41,300~~	~~148,000~~
~~#5H~~	~~41,800~~	~~150,000~~
~~#6~~	~~42,900~~	~~154,000~~
~~Gas~~	~~kJ/m³~~	~~Btu/ft³~~
~~Natural Gas~~	~~38,400~~	~~1030~~
	~~kJ/L~~	~~Btu/U.S. gal~~
~~Propane~~	~~25,500~~	~~91,600~~
~~Electricity~~	~~kJ/kWh~~	~~Btu/kWh~~
	~~3600~~	~~3412~~

~~*Informative Note:* Energy accounting and conversion factors shown in Table 5-1 are based on *site energy*.~~

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_2e/kBtu)~~	~~Greenhouse Gas Emissions Factor, GWP_{100} (kg CO_2e/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 liquified 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 CO_2e/kBtu (I-P) or 0.104 kg CO_2e/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 CO_2e/kBtu (I-P) or 0.000 kg CO_2e/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.~~

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

~~a. 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~~

Commented [A55]: Remove this conversion factor table and defer to Energy Star Portfolio Manager

Commented [A56]: No source energy or GHG emissions conversion factors needed.

Note: These draft rules for the June 5, 2024 public meeting cover Chapters 1-6 only. Comments may be made at:
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~~b. Substitute other *source energy* conversion factors for electricity and other energy forms following the processes and procedures incorporated within ANSI/ASHRAE Standard 105 [a]~~

~~c. Substitute other locally appropriate *source energy* conversion factors~~

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

eGrid 2018 Subregion Acronym	eGrid 2018 Subregion 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
FRCC	FRCC 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.

5.2.3.3 Greenhouse Gas Emissions. *GHG emissions* shall be calculated using Equation 5-4:

$$GHG\ emissions = Site\ energy_1 \times GEF_1 + \ldots + Site\ energy_i \times GEF_i + \ldots + Site\ energy_n \times GEF_n \quad (5\text{-}4)$$

where

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

GEF_i = *GHG emissions* conversion factor associated with energy form *i*, where *i* equals 1 to *n*, as listed in Table 5-2

The *AHJ* shall be permitted to

a. Substitute the national grid electricity *GHG emissions* conversion factor in Table 5-2 with the appropriate regional factor in Table 5-4 applicable to the *building* location

b. Substitute other *GHG emissions* conversion factors for electricity and other energy forms following the processes and procedures incorporated in ANSI/ASHRAE Standard 105.[2]

Commented [A57]: No source energy conversion factors needed for Oregon's BPS. These have been removed for clarity.

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~~c. Specify *GHG emissions* conversion factors for energy sources not listed in Table 5-4~~
~~d. Allow *buildings* to use *GHG emissions* conversion factors for any or all energy forms procured from specific energy providers~~

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Table 5-4 U.S. Regional Electricity Greenhouse Gas Emissions Factors

eGrid 2018 Sub-region Acronym	eGrid 2018 Subregion Name	Greenhouse Gas Emissions Factor, lb CO_2e/kBtu	Greenhouse Gas Emissions Factor, kg CO_2e/MJ
AKGD	ASCC Alaska Grid	0.372	0.160
AKMS	ASCC Miscellaneous	0.192	0.083
ERCT	ERCOT All	0.328	0.141
FRCC	FRCC All	0.322	0.139
HIMS	HICC Miscellaneous	0.433	0.186
HIOA	HICC Oahu	0.592	0.254
MROE	MRO East	0.563	0.242
MROW	MRO West	0.416	0.179
NYLI	NPCC Long Island	0.435	0.187
NEWE	NPCC New England	0.202	0.087
NYCW	NPCC NYC/Westchester	0.230	0.099
NYUP	NPCC Upstate NY	0.101	0.044
RFCE	RFC East	0.258	0.111
RFCM	RFC Michigan	0.441	0.189
RFCW	RFC West	0.395	0.170
SRMW	SERC Midwest	0.534	0.229
SRMV	SERC Mississippi Valley	0.312	0.134
SRSO	SERC South	0.359	0.154
SRTV	SERC Tennessee Valley	0.351	0.151
SRVC	SERC Virginia/Carolina	0.263	0.113
SPNO	SPP North	0.388	0.167
SPSO	SPP South	0.399	0.172
CAMX	WECC California	0.178	0.077
NWPP	WECC Northwest	0.215	0.093
RMPA	WECC Rockies	0.424	0.183
AZNM	WECC Southwest	0.355	0.153

Commented [A58]: No source energy conversion factors needed for Oregon's BPS. These have been removed for clarity.

5.2.4 The *energy and emissions accounting system* shall be Energy Star Portfolio Manager. perform the following.

5.2.4.1 Record annual *gross energy* consumption data for each *building*, including all forms of purchased, on-site generated, and exported energy from at least 12 consecutive months of data.

5.2.4.2 Record total *gross energy* use expressed as Btu/year (MJ/year).

5.2.4.3 Record each *nonresidential building's EUI* as follows, as applicable:

a. Annual *gross energy* use, MJ/*gross floor area for nonresidential buildings*, m^2

b. Annual *gross energy* use, kBtu/*gross floor area for nonresidential buildings*, ft^2

5.2.4.4 Record each *residential building's EUI* as follows, as applicable:

a. annual *gross energy* use, MJ/*gross floor area for residential buildings*, m^2

b.5.2.4 annual *gross energy* use, kBtu/*gross floor area for residential buildings*, ft^2

5.2.4.5 Record each *nonresidential building's GHGI* as follows, as applicable:

a. Annual *GHG emissions*, kg CO_2e/*gross floor area for nonresidential buildings*, m^2

b. Annual *GHG emissions*, lb CO_2e/*gross floor area for nonresidential buildings*, ft^2

5.2.4.6 Record each *residential building's GHGI* as follows, as applicable:

Commented [A59]: ESPM will be used to report and account energy usage

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~~[a] Annual *GHG emissions*, kg CO_2e/*gross floor area for residential buildings*, m^2~~
~~[b] Annual *GHG emissions*, lb CO_2e/*gross floor area for residential buildings*, ft^2~~

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5.3 Energy Manager. The *EM* ~~shall~~ *may* be responsible for the following.

5.3.1 Conducting technical, policy-related planning related to energy efficiency.

5.3.2 Purchasing energy for spaces under his or her control.

5.3.3 Public relations matters related to energy.

5.3.4 Implementing the results of energy audits and *EEMs* outlined in the energy management plan.

5.3.5 Evaluating energy efficiency of proposed new construction, facility expansion, remodeling, or new equipment purchases.

5.3.6 Reviewing *building* O&M procedures for optimal energy management.

5.3.7 Adhering to energy codes and standards.

5.3.8 Reporting regularly to management and other stakeholders.

5.3.9 Developing and implementing an energy efficiency plan according to Section 9.1.

6. OPERATIONS AND MAINTENANCE REQUIREMENTS

6.1 Scope. Section 6 applies to the *building* envelope, *building* systems, and *building* equipment that directly or indirectly consume energy.

6.2 Operations and Maintenance Program. A formal operations and maintenance (O&M) program shall be established and implemented in order that the *building* energy-using systems achieve their intended energy efficiency throughout their service life.

The program documents the O&M objectives, establishes the criteria for evaluation, and commits the *building operator* and maintenance personnel to basic goals of *performance* (such as minimizing equipment failures, ensuring ongoing efficient operation, and performing identified maintenance requirements).

6.3 Operations and Maintenance Implementation. The O&M program shall be implemented in accordance with Normative Appendix C.

~~**6.3**~~ **Exception to 6.3:** O&M programs developed and implemented by the *building*'s serving utility or local government and approved as equivalent or more stringent by the *AHJ* may be used as an alternative to the requirement in Section 6.3. Where local government programs are more stringent than applicable utility programs, local government programs shall be selected over utility programs.

6.4 Operations and Maintenance Tasks

6.4.1 Maintenance for all equipment, components, and systems shall be in accordance with applicable manufacturers' requirements and shall also include tasks that minimize failures, *maintain* energy consumption efficiency, and reduce *building GHG emissions*, such as those found in Informative Appendix I for the following *building* systems:

- *Building* envelope
- Domestic hot water
- Heating, ventilation, and air conditioning
- Refrigeration
- Lighting
- Controls
- Electric power distribution and on-site power generation

6.4.2 Safe and reasonable access shall be provided to all equipment covered by the O&M program for inspection, maintenance, and repairs.

6.4.3 The O&M requirements shall be reevaluated when *building* use changes or renovations/alterations are made that affect the facility's operations.

6.5 Tenant Improvements. The *energy manager* shall put in place a formal process to ensure that any tenant improvements involving a change in space use or the relocation of partitions (including partial height partitions) do not change the annual energy use or *GHG emissions* except to the extent that the annual energy use or *GHG emissions* change (increase or decrease) is consistent with any change in the *building*'s *performance targets*.

6.6 Equipment and Component Replacement

6.6.1 Equipment and component replacement shall be performed in accordance with the *capital*

Commented [A60]: Edited from "shall" to "may", as it is likely not appropriate to explicitly define other organizational personnel roles not related to BPS compliance. These are, however, best practices that could benefit building operations.

Commented [A61]: Similar exception in WA

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management plan, if applicable, described in Section 5.1.2.11. Replacement equipment shall meet all applicable energy efficiency requirements in the federal equipment standards, *state equipment standards,* and the *applicable building code.*

Exception to 6.6: Equipment intended for standby or emergency use only.

6.6.1 Lighting Replacement

6.6.1.1 When lighting equipment is replaced, the replacement equipment shall meet ~~the most stringent~~all applicable energy efficiency requirements in ~~both the~~ federal equipment standards, state equipment standards, and in the applicable *building* code.

6.6.1.2 The replacement of any lighting equipment shall not increase the existing installed lighting power demand.

Exception to 6.6.1.2: The existing installed lighting power may proportionally increase when the current light levels are below those recommended in the IES *Lighting Handbook* [4].

Commented [A62]: Addition similar to WA

Commented [A63]: "most stringent" language seems unnecessary

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7. ENERGY USE AND GREENHOUSE GAS EMISSIONS ANALYSIS AND TARGET REQUIREMENTS

7.1 Building Type, Energy Use Intensity Targets, and Greenhouse Gas Intensity Targets

7.1.1 Building Type. *Buildings* are divided into 55 types with activities as shown in Table 7-1. *Buildings* with one or more activities listed in Table 7-1 have *energy use intensity* (*EUI*) *targets* as shown in Table 7-2 or 7-3.

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.

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:

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

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.

7.1.3 Greenhouse Gas Intensity Targets. *GHGI targets* are shown in Table 7-4 in both I-P and SI units. *GHGI targets* were derived from *EUI targets* based on *site energy* as described in Section 7.1.2 using the GHG conversion factors shown in Table 5-2.

7.1.3.1 Greenhouse Gas Intensity Targets with Custom Greenhouse Gas Emission Conversion Factors. When an *AHJ* uses a *GHG emission* conversion factor other than those in Table 5-2 for calculating *GHG emissions*, Tables 7-5 and 7-6 shall be used to generate *GHGI targets* in conjunction with the *GHG emission* conversion factors used to calculate *GHG emissions* in Section 5.2. *Performance targets* shall be calculated using Equation 7-2:

$$GHGI_{t1} = (ELUI_{t1} \times GEF_{el}) + (FEUI_{t1} \times GEF_{fe}) \quad (7\text{-}2)$$

where

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

GEF_{el} = GHG conversion factor for electricity use

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

GEF_{fe} = GHG conversion factor for fossil-fuel energy use

7.2 Determining Energy Use Intensity Target

7.2.1 The *energy manager* (*EM*) or *qualified person* shall determine the *EUI target* according to Section 7.2.2 for single-type/activity *buildings* and Section 7.2.3 for mixed-use *buildings*, and shall complete Form B.

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

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

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.

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Table 7-1 Commercial and Residential Building Types/Activities

Table 7-1 Building Activity Types/Activities

Building Activity Type[1,2]				
No.	**Portfolio Manager Types**	**Portfolio Manager Subtypes**	**Subtypes: Detailed**	**Notes**
1	Banking/financial services	Bank branch		
2	Banking/financial services	Financial office		
3	Education	Adult education		
4	~~Education~~	~~College/university~~		
5	~~Education~~	~~K-12 school~~	~~Elementary/middle school~~	
6	~~Education~~	~~K-12 school~~	~~High school~~	
7	~~Education~~	~~Preschool/daycare~~		
8	~~Education~~	~~Vocational school~~		
9	~~Education~~	~~Other—education~~		
10	Entertainment/public assembly	Aquarium		
11	Entertainment/public assembly	Bar/nightclub		
12	Entertainment/public assembly	Bowling alley		
13	Entertainment/public assembly	Casino		
14	Entertainment/public assembly	Convention center		
15	Entertainment/public assembly	Fitness center/health club/gym		
16	Entertainment/public assembly	Ice/curling rink		
17	Entertainment/public assembly	Indoor arena		
18	Entertainment/public assembly	Movie theater		
19	Entertainment/public assembly	Museum		
20	Entertainment/public assembly	Performing arts		
21	Entertainment/public assembly	Race track		
22	Entertainment/public assembly	Roller rink		
23	Entertainment/public assembly	Social/meeting hall		
24	Entertainment/public assembly	Stadium (closed)		
25	Entertainment/public assembly	Stadium (open)		
26	Entertainment/public assembly	Swimming pool		
27	Entertainment/public assembly	Zoo		
28	Entertainment/public assembly	Other—entertainment/public assembly	Entertainment/culture	
29	Entertainment/public assembly	Other—entertainment/public assembly	Library	
30	Entertainment/public assembly	Other—entertainment/public assembly	Other public assembly	
31	Entertainment/public assembly	Other—entertainment/public assembly	Recreation	
32	Entertainment/public assembly	Other—entertainment/public assembly	Social/meeting	
33	Entertainment/public assembly	Other—recreation		
34	Entertainment/public assembly	Other—stadium		
35	Food sales and service	Bar/nightclub		
36	Food sales and service	Convenience store with gas station		
37	Food sales and service	Convenience store without gas station		
38	Food sales and service	Fast food restaurant		
39	Food sales and service	Food sales	Grocery/food market	
40	Food sales and service	Food sales	Convenience store with gas	
41	Food sales and service	Food sales	Convenience store	
42	Food sales and service	Food sales	Other food sales	
43	Food sales and service	Food service	Fast food	
44	Food sales and service	Food service	Restaurant/cafeteria	
45	Food sales and service	Food service	Other food service	
46	Food sales and service	Restaurant		

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47	Food sales and service	Supermarket/grocery store	
48	Food sales and service	Wholesale club/supercenter	
49	Food sales and service	Other—restaurant/bar	
~~50~~	~~Healthcare~~	~~Ambulatory surgical center~~	
~~51~~	~~Healthcare~~	~~Hospital (general medical and surgical)*~~	
52	Healthcare	Medical office	3
53	~~Healthcare~~	~~Outpatient rehabilitation/physical therapy~~	
54	~~Healthcare~~	~~Residential care facility~~	
55	~~Healthcare~~	~~Senior care community~~	
56	~~Healthcare~~	~~Urgent care/clinic/other outpatient~~	
57	~~Healthcare~~	~~Other—specialty hospital~~	
58	Lodging/residential	Barracks	

59	Lodging/residential	Hotel	Hotel	
60	Lodging/residential	Hotel	Motel or inn	
~~61~~	~~Lodging/residential~~	~~Multifamily housing~~		
62	Lodging/residential	Prison/incarceration		
~~63~~	~~Lodging/residential~~	~~Residence hall/dormitory~~		
~~64~~	~~Lodging/residential~~	~~Residential care facility~~		
65	~~Lodging/residential~~	~~Senior care community~~		
66	~~Lodging/residential~~	~~Other—lodging/residential~~		
67	Mixed-use	Mixed-use property	4	
68	Office	Medical office	3	
69	Office	Office	Admin/professional office	
70	Office	Office	Bank/other financial	
71	Office	Office	Government office	
72	Office	Office	Medical office (diagnostic)	3
73	Office	Office	Other office	
74	Office	Veterinary office		
75	Office	Other—office		
76	Public services	Courthouse		
77	Public services	Fire station		
78	Public services	Library		
79	Public services	Mailing center/post office		
80	Public services	Police station		
81	Public services	Prison/incarceration		
82	Public services	Social/meeting hall		
83	Public services	Transportation terminal/station		
84	Public services	Other—public service		
85	Religious worship	Worship facility		
86	Retail	Automobile dealership		
87	Retail	Convenience store with gas station		
88	Retail	Convenience store without gas station		

89	Retail	Enclosed mall	5	
90	Retail	Lifestyle center	Enclosed mall	5
91	Retail	Lifestyle center	Other retail	
92	Retail	Lifestyle center	Retail store	
93	Retail	Lifestyle center	4	
94	Retail	Retail store		
95	Retail	Strip mall	4	
96	Retail	Supermarket/grocery store		
97	Retail	Wholesale club/supercenter		

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98	Retail	Other—retail/mall	Enclosed mall	5
99	Retail	Other—retail/mall	4	
100	Technology/science	Data center	6	
101	Technology/science	Laboratory		
102	Technology/science	Other—technology/science	Other service	
103	Services	Personal services (health/beauty, dry cleaning, etc.)		
104	Services	Repair services(vehicle, shoe, lock-smith, etc.)	Repair shop	
105	Services	Repair services(vehicle, shoe, lock-smith, etc.)	Vehicle service/repair shop	
106	Services	Repair services(vehicle, shoe, lock-smith, etc.)	Vehicle storage/maintenance	
107	Services	Other—services		
108	Utility	Energy/power station	7	
109	Utility	Other—utility	7	
110	Warehouse/storage	Self-storage facility		
111	Warehouse/storage	Distribution center		
112	Warehouse/storage	Nonrefrigerated warehouse		
113	Warehouse/storage	Refrigerated warehouse		

Table 7-1 Building Activity Types/Activities

No.	Commercial Building Type	No.	Commercial Building Type
1	Admin/professional office	30	Fast food
2	Bank/other financial	31	Restaurant/cafeteria
3	Government office	32	Other food service
4	Medical office (nondiagnostic)	33	Hospital/inpatient health
5	Mixed-use office	34	Nursing home/assisted living
6	Other office	35	Dormitory/fraternity/sorority
7	Laboratory	36	Hotel
8	Distribution/ship center	37	Motel or inn
9	Nonrefrigerated warehouse	38	Other lodging
10	Convenience store	39	Vehicle dealership/showroom
11	Convenience store + gas	40	Retail store
12	Grocery/food market	41	Other retail
13	Other food sales	42	Post office/postal center
14	Fire/police station	43	Repair shop
15	Other public order/safety	44	Vehicle service/repair shop
16	Medical office (diagnostic)	45	Vehicle storage/maintenance
17	Clinic/other outpatient health	46	Other service
18	Refrigerated warehouse	47	Strip shopping mall
19	Religious worship	48	Enclosed mall
20	Entertainment/culture	49	Bar/pub/lounge
21	Library	50	Courthouse/probation office
22	Recreation	**No.**	**Residential Building Type**

23	Social/meeting	51	Mobile home
24	Other public assembly	52	Single-family detached
25	College/university	53	Single-family attached
26	Elementary/middle school	54	Apartment *building* (2 to 4 units)
27	High school	55	Apartment *building* (5+ units)
28	Preschool/daycare		
29	Other classroom education		

Informative Note: Apartments with units where all utilities are submetered are considered as single-family attached residences, and those with at least one type of utility not submetered, (e.g., hot water, steam) are considered as nonresidence (#53). Examples: social housing, leased condos.

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:

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

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*

Exceptions to 7.2.3:

1. Spaces where more than 75% of the gross floor area has a unique *building* activity shall be reported as a single-use *building* or as a multiuse *building* in accordance with either Section 7.2.2 or Section 7.2.3.

Note: These draft rules for the June 5, 2024 public meeting cover Chapters 1-6 only. Comments may be made at:
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2. Spaces less than 10% of the gross floor area with a unique *building* activity can combine their floor area with the floor area within the *building* that has a similar *building* activity as determined by the *EM* or other *qualified person*.
3. Spaces in *buildings* with multiple activities that are not listed in Table 7-1 and have a total combined area $\Sigma A_{nontarget}$ comprising less than 10% of the *building* gross floor area A_{gross} can be excluded from *building EUI target* calculations if the energy use of such space is metered separately. The *EUI target* for the remaining part of the *building* shall be calculated after deducting the unlisted *building* type floor area from the *building* gross floor area ($A_{gross} - \Sigma A_{nontarget}$).
4. Spaces in multiple-activity *buildings*, with activities not listed in Table 7-1, comprising more than 10% but not more than 50% of the gross floor area shall comply with either Section 7.2.3, Exception 3, or Sections 4.2, 4.3, 4.4.1, and 4.4.3.

7.2.4 Energy Use Intensity Targets for Vacant and Partially Vacant Buildings

7.2.4.1 The *EUI target* for a 100% vacant *building* shall be based on its prevacancy activity if the intended use of the *building* will be unchanged.

7.2.4.2 If the total floor area of a nonheated, noncooled, and nonilluminated vacant part of a *building* is less than 30% of the gross floor area, then it shall be excluded from the gross floor area, and the *EUI target* shall be determined based on the remainder of the *building* as described in Section 7.2.3.

7.2.4.3 If the vacant part of a *building* is heated and/or cooled and the *building* energy use data for a recent 12 consecutive month period when the *building* was occupied is not available, compliance of this part of the *building* will be determined after it becomes occupied and energy use data become available for 12 consecutive months.

7.3 Determining Greenhouse Gas Intensity Target

7.3.1 The *energy manager* (*EM*) or *qualified person* shall determine the *GHGI target* according to Section 7.3.2 for single type/activity *buildings* and Section 7.3.3 for mixed-use *buildings*, and shall complete Form B.

7.3.2 *GHGI targets* for *buildings* with a single activity shall be calculated using Equation 7-5:

$$GHGI_t = S \times (GHGI_{t1}) \quad (7\text{-}5)$$

where

$GHGI_{t1}$ = *building* activity *GHGI target* value in Table 7-4 for the appropriate *building* activity/type and climate

S = *building* operating shifts normalization factor in Table 7-7

7.3.3 *GHGI targets* for *buildings* with multiple activities shall be determined using weighted averages of *building* activity *GHGI target* for each area with a single activity using Equation 7-6 and shall be reported on Form B:

$$GHGI_t = A_1 \times S_1 \times (GHGI_{t1})_1 + \ldots + A_i \times S_i \times (GHGI_{t1})_i + \ldots + A_n \times S_n \times (GHGI_{t1})_n \quad (7\text{-}6)$$

where

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

$(GHGI_{t1})_i$ = *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*

Exceptions to 7.3.3:

1. Spaces where more than 75% of the gross floor area has a unique *building* activity shall be reported as a single-use *building* or as a multiuse *building* in accordance with either Section 7.2.2 or Section 7.2.3.
2. Spaces less than 10% of the gross floor area with a unique *building* activity are permitted to combine their floor area with the floor area within the *building* that has a similar *building* activity as determined by the *EM* or other *qualified person*.
3. Spaces in *buildings* with multiple activities that are not listed in Table 7-1 and have a total combined area, $\Sigma A_{nontarget}$, comprising less than 10% of the *building* gross floor area, A_{gross}, are permitted to be

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excluded from *building GHGI target* calculations if the energy use of such space is metered separately. The *GHGI target* for the remaining part of the *building* shall be calculated after deducting the unlisted *building* type floor area from the *building* gross floor area ($A_{gross} - \Sigma A_{nontarget}$).

4. Spaces in multiple-activity *buildings*, with activities not listed in Table 7-1, comprising more than 10% but not more than 50% of the gross floor area shall comply with either Section 7.2.3, Exception 3, or Sections 4.2, 4.3, 4.4.1, and 4.4.3.

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Table 7-2a Building Activity Site Energy Use Intensity Targets (EUI_{t1}) (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	44	44	38	41	38	36	37	29	35	31	39	35	34	40	37	34	45	41	50	60
2	Bank/other financial	74	75	64	70	64	61	64	50	59	53	67	60	58	68	64	57	78	69	86	103
3	Government office	48	49	42	46	42	40	42	33	39	35	43	39	38	45	42	37	51	45	56	67
4	Medical office (nondiagnostic)	43	44	37	41	37	35	37	29	34	31	39	35	34	40	37	33	45	40	50	60
5	Mixed-use office	38	39	33	36	33	31	33	26	31	27	35	31	30	35	33	30	40	36	44	53
6	Other office	37	37	32	35	32	30	31	25	29	26	33	30	29	34	31	28	38	34	42	51
7	Laboratory	125	124	109	118	109	103	111	90	104	93	119	108	106	125	116	107	142	129	157	189
8	Distribution/shipping center	8	12	8	12	11	13	19	11	16	12	28	22	21	37	31	24	51	41	64	86
9	Nonrefrigerated warehouse	5	7	5	7	7	8	12	7	10	7	17	13	13	22	19	15	31	25	39	52
10	Convenience store	145	145	132	143	143	136	155	136	145	136	171	154	162	184	169	170	203	186	222	259
11	Convenience store with gas	164	163	149	161	161	153	175	154	164	153	192	174	182	207	190	192	228	210	251	292
12	Grocery store/food market	132	131	120	129	129	123	140	123	132	123	155	140	147	167	153	154	184	169	202	235
13	Other food sales	145	144	131	142	142	135	154	135	145	135	170	153	161	183	168	169	201	185	221	257
14	Fire station/police station	45	45	39	43	40	37	40	33	38	34	43	39	39	45	42	39	51	47	57	69
15	Other public order and safety	95	94	82	90	83	78	84	68	79	70	90	82	81	95	88	81	108	98	119	144
16	Medical office (diagnostic)	43	41	41	41	39	40	40	36	40	34	40	39	36	40	40	34	43	43	45	49
17	Clinic/other outpatient health	48	45	46	45	43	44	45	40	44	38	45	44	40	45	45	38	48	48	50	54
18	Refrigerated warehouse	68	67	59	64	59	56	60	48	56	50	64	58	57	68	62	58	77	69	85	102
19	Religious worship	23	22	20	21	20	19	20	16	19	17	21	19	19	23	21	19	26	23	28	34
20	Entertainment/culture	36	35	31	34	31	30	32	26	30	26	34	31	30	36	33	31	41	37	45	54
21	Library	56	56	49	53	49	46	50	40	46	41	53	48	48	56	52	48	64	58	70	85
22	Recreation	41	40	35	38	35	34	36	29	34	30	39	35	35	41	38	35	46	42	51	62
23	Social/meeting	38	37	33	35	33	31	33	27	31	28	36	32	32	38	35	32	42	39	47	57
24	Other public assembly	45	45	39	42	39	37	40	32	37	33	43	39	38	45	42	39	51	46	57	68
25	College/university	79	74	59	71	60	55	61	42	56	45	71	60	62	79	67	64	94	81	108	141
26	Elementary/middle school	39	38	32	36	32	31	33	26	30	27	36	32	32	38	35	31	43	39	49	63

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Table 7-2a Building Activity Site Energy Use Intensity Targets (EUI_{t1}) (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
27	High school	57	54	43	51	43	40	44	31	40	33	51	43	45	57	49	46	68	58	78	102
28	Preschool/daycare	54	53	45	51	45	43	46	36	42	37	50	45	44	53	48	44	60	54	68	88
29	Other classroom education	33	32	27	31	27	26	28	22	26	23	30	27	27	32	29	26	36	33	41	53
30	Fast food	286	282	264	278	269	269	285	247	274	256	312	289	293	339	314	306	375	346	413	482
31	Restaurant/cafeteria	205	199	184	197	188	186	201	169	191	177	223	206	211	241	223	222	265	246	291	338
32	Other food service	72	70	64	69	66	65	70	59	67	62	78	72	74	85	78	78	93	86	102	119
33	Hospital/inpatient health	181	185	169	177	178	158	174	156	160	162	175	159	164	168	156	154	175	165	181	192
34	Nursing home/assisted living	78	78	60	74	63	63	75	53	68	53	94	78	85	109	92	93	127	111	146	181
35	Dormitory/ fraternity/sorority	41	41	32	39	33	33	39	28	35	28	49	41	44	57	48	49	67	58	77	95
36	Hotel	48	46	43	44	45	41	46	42	43	41	50	46	47	54	51	49	60	56	65	74
37	Motel or inn	51	50	46	47	44	42	42	38	41	39	42	41	39	43	42	39	46	43	49	54
38	Other lodging	61	60	54	56	52	50	50	46	49	47	50	48	47	51	50	47	55	52	58	64
39	Vehicle dealership/ showroom	43	44	37	41	38	36	42	30	38	32	48	42	42	55	49	46	65	58	76	95
40	Retail store	36	36	30	34	31	30	35	25	32	26	40	35	35	46	41	38	54	48	63	79
41	Other retail	50	51	43	48	44	42	49	35	45	37	56	49	49	64	57	54	76	67	88	111
42	Post office/postal center	44	45	34	42	36	36	43	30	39	30	54	44	48	62	53	53	73	63	84	103
43	Repair shop	10	14	9	15	14	16	23	14	20	14	33	27	26	45	37	29	61	50	78	104
44	Vehicle service/repair shop	13	18	12	19	18	20	30	18	25	18	42	34	33	57	48	37	78	64	99	133
45	Vehicle storage/ maintenance	9	13	9	14	13	15	22	13	19	14	32	26	25	43	36	28	58	48	74	99
46	Other service	14	19	13	20	19	22	32	19	27	20	46	37	36	62	52	40	85	69	107	144
47	Strip shopping mall	78	79	67	75	66	64	73	52	67	56	84	73	75	97	85	81	114	101	132	167
48	Enclosed mall	47	48	40	45	40	39	44	31	40	34	51	44	45	58	51	48	69	61	80	100
49	Bar/pub/lounge	89	87	80	86	82	81	87	74	83	77	97	90	92	105	97	97	115	107	127	147
50	Courthouse/probation office	80	78	69	73	71	63	71	57	63	60	74	63	65	72	65	61	81	71	88	103

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Table 7-2a Building Activity Site Energy Use Intensity Targets (EUI_{t1}) (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	37	37	29	36	30	30	36	26	32	25	45	37	41	52	44	49	61	53	70	87
52	Single-family detached	32	32	25	30	26	26	31	22	28	22	38	32	35	44	37	36	52	45	60	74
53	Single-family attached	30	30	23	28	24	24	29	20	26	20	36	29	32	41	35	42	48	42	56	69
54	Apartment (in 2 to 4 unit *building*)	35	35	27	33	28	28	33	24	30	24	42	34	38	48	41	61	56	49	65	80
55	Apartment (in 5+ unit *building*)	27	28	21	26	22	22	27	19	24	19	33	27	30	38	32	42	45	39	52	64

Table 7-2b Building Activity Site Energy Use Intensity Targets (EUI_{t1}) (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	494	503	427	467	428	404	425	335	395	353	444	403	389	455	424	381	517	462	571	685
2	Bank/other financial	843	857	727	796	729	688	725	571	673	601	757	686	663	777	724	649	881	789	973	1168
3	Government office	550	559	475	520	476	449	473	372	439	392	494	448	433	507	472	423	575	514	635	762
4	Medical office (nondiagnostic)	488	497	421	461	422	399	420	331	390	348	438	398	384	450	419	376	510	457	564	677
5	Mixed-use office	437	444	377	413	378	357	376	296	349	312	392	356	344	403	375	336	457	409	504	606
6	Other office	415	422	358	392	359	339	357	281	331	296	372	338	326	382	356	319	433	388	479	575
7	Laboratory	1424	1409	1233	1340	1237	1173	1263	1020	1177	1052	1349	1224	1206	1424	1314	1216	1611	1462	1785	2150
8	Distribution/shipping center	93	131	89	138	130	150	219	129	187	136	313	253	244	422	352	274	577	469	730	981
9	Nonrefrigerated warehouse	56	79	54	83	78	91	132	78	113	82	188	153	147	254	212	165	347	283	440	590
10	Convenience store	1652	1645	1499	1621	1620	1542	1760	1547	1652	1543	1938	1753	1836	2090	1917	1932	2302	2118	2525	2939
11	Convenience store with gas	1862	1854	1690	1827	1826	1738	1984	1743	1862	1739	2184	1976	2070	2356	2161	2178	2595	2387	2847	3313
12	Grocery store/food market	1497	1491	1359	1469	1469	1398	1595	1402	1498	1398	1757	1589	1664	1894	1738	1751	2087	1919	2289	2664
13	Other food sales	1641	1634	1490	1610	1610	1532	1749	1537	1642	1533	1926	1742	1825	2077	1905	1920	2287	2104	2509	2920
14	Fire station/police station	517	511	447	486	449	425	458	370	427	382	489	444	438	517	477	441	584	530	647	780
15	Other public order and safety	1082	1070	937	1018	939	891	959	775	894	799	1024	929	916	1082	998	924	1223	1110	1355	1633

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Table 7-2b Building Activity Site Energy Use Intensity Targets (EUI_{t1}) (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
16	Medical office (diagnostic)	489	462	470	461	440	449	455	411	450	383	457	448	407	456	457	391	489	485	507	553
17	Clinic/other outpatient health	546	516	524	514	491	501	507	458	502	428	510	500	454	509	510	437	546	541	565	617
18	Refrigerated warehouse	768	760	665	723	667	633	681	550	635	568	727	660	651	768	709	656	869	788	963	1160
19	Religious worship	256	254	222	241	223	211	227	184	212	189	243	220	217	256	237	219	290	263	321	387
20	Entertainment/culture	407	403	353	383	354	335	361	292	336	301	386	350	345	407	376	348	461	418	510	615
21	Library	638	631	552	600	554	525	565	457	527	471	604	548	540	638	588	545	721	654	799	963
22	Recreation	464	459	402	437	403	382	411	332	383	343	439	399	393	464	428	396	525	476	581	701
23	Social/meeting	426	422	369	401	370	351	378	305	352	315	404	366	361	426	394	364	482	438	534	644
24	Other public assembly	513	507	444	482	445	422	454	367	423	379	485	440	434	513	473	438	580	526	642	774
25	College/university	898	842	673	802	680	629	698	482	630	514	801	678	700	895	766	725	1062	917	1224	1597
26	Elementary/middle school	442	432	366	414	364	349	374	294	346	305	406	367	360	429	394	356	491	443	557	720
27	High school	649	609	486	579	491	455	504	348	455	371	579	490	506	647	553	524	767	662	884	1154
28	Preschool/daycare	616	602	510	577	507	487	521	410	482	426	566	512	502	597	549	496	684	618	777	1004
29	Other classroom education	373	364	309	349	307	295	315	248	292	258	342	310	304	362	332	300	414	374	470	608
30	Fast food	3245	3199	2994	3158	3060	3053	3234	2809	3108	2903	3546	3279	3325	3853	3569	3474	4260	3927	4685	5471
31	Restaurant/cafeteria	2327	2265	2087	2242	2131	2111	2278	1920	2171	2010	2528	2334	2396	2738	2531	2526	3008	2793	3302	3840
32	Other food service	816	794	732	786	747	740	799	673	761	705	886	819	840	960	887	886	1055	979	1158	1347
33	Hospital/inpatient health	2058	2097	1916	2013	2019	1791	1975	1774	1816	1843	1987	1805	1865	1906	1774	1755	1992	1878	2051	2186
34	Nursing home/assisted living	884	887	685	843	716	712	856	606	770	603	1072	881	964	1234	1046	1053	1446	1259	1663	2052
35	Dormitory/ fraternity/sorority	463	464	358	441	375	373	448	317	403	315	561	461	504	646	547	551	757	659	870	1074
36	Hotel	542	517	484	505	507	470	525	479	490	466	573	525	533	613	577	557	676	631	737	843
37	Motel or inn	576	567	517	537	499	480	477	435	465	444	477	462	443	488	472	445	525	491	553	610
38	Other lodging	687	676	617	641	596	573	569	519	555	529	570	551	529	582	563	531	627	586	660	728
39	Vehicle dealership/ showroom	493	495	416	468	431	412	480	339	435	360	547	481	479	625	558	522	742	655	859	1083
40	Retail store	408	411	345	388	357	342	398	281	360	298	453	398	397	518	463	433	615	543	712	897

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Table 7-2b Building Activity Site Energy Use Intensity Targets (EUI_{t1}) (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	573	576	484	545	502	480	558	394	505	419	636	559	558	727	649	608	863	762	999	1259
42	Post office/postal center	505	507	391	482	409	407	489	346	440	344	613	503	551	705	597	601	826	719	950	1172
43	Repair shop	112	158	108	166	157	181	264	156	225	164	377	305	294	509	425	331	696	566	880	1182
44	Vehicle service/repair shop	144	202	137	212	201	232	338	199	288	209	482	391	376	651	543	423	890	723	1126	1512
45	Vehicle storage/ maintenance	107	151	103	158	150	173	252	149	215	156	360	292	281	486	405	316	664	540	841	1129
46	Other service	155	218	148	229	217	250	365	215	311	226	520	421	405	703	586	456	960	780	1215	1631
47	Strip shopping mall	888	897	755	851	751	727	830	587	760	641	955	834	848	1098	968	915	1298	1147	1503	1892
48	Enclosed mall	534	540	454	512	452	437	499	353	457	386	574	502	510	661	582	551	781	690	904	1138
49	Bar/pub/lounge	1014	987	910	977	929	920	993	837	946	876	1102	1017	1044	1193	1103	1101	1311	1217	1439	1674
50	Courthouse/probation office	904	885	786	835	808	711	802	650	710	683	844	719	741	822	742	692	920	811	999	1174

		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	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

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Table 7-3a Building Activity Source Energy Use Intensity Targets (EUI_{t1}) (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	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

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Table 7-3a Building Activity Source Energy Use Intensity Targets (EUI_{t1}) (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	107	104	88	82	73	68	69	57	67	55	74	72	65	68	64	65	78	68	88	117
27	High school	157	147	117	114	99	89	93	68	89	67	105	95	92	103	90	95	122	102	140	187
28	Preschool/daycare	149	145	123	114	102	95	96	80	94	77	103	100	91	95	89	90	109	95	123	163
29	Other classroom education	90	88	75	69	62	57	58	48	57	47	62	60	55	58	54	54	66	58	74	99
30	Fast food	783	772	722	622	615	595	594	547	606	526	644	639	603	614	581	630	678	605	742	889
31	Restaurant/cafeteria	561	547	504	442	428	411	418	374	423	364	459	455	434	436	412	458	479	430	523	624
32	Other food service	197	192	177	155	150	144	147	131	148	128	161	159	152	153	144	161	168	151	183	219
33	Hospital/inpatient health	497	506	462	397	405	349	363	346	354	334	361	352	338	304	289	318	317	289	325	355
34	Nursing home/assisted living	213	214	165	166	144	139	157	118	150	109	195	172	175	197	170	191	230	194	263	333
35	Dormitory/ fraternity/sorority	112	112	86	87	75	73	82	62	78	57	102	90	91	103	89	100	121	102	138	174
36	Hotel	131	125	117	100	102	91	96	93	95	85	104	102	97	98	94	101	108	97	117	137
37	Motel or inn	139	137	125	106	100	94	88	85	91	80	87	90	80	78	77	81	84	76	88	99
38	Other lodging	166	163	149	126	120	112	105	101	108	96	103	107	96	93	92	96	100	90	105	118
39	Vehicle dealership/ showroom	119	120	100	92	87	80	88	66	85	65	99	94	87	100	91	95	118	101	136	176
40	Retail store	99	99	83	76	72	67	73	55	70	54	82	78	72	83	75	79	98	84	113	146
41	Other retail	138	139	117	107	101	93	102	77	98	76	115	109	101	116	106	110	137	117	158	205
42	Post office/postal center	122	122	94	95	82	79	90	67	86	62	111	98	100	112	97	109	132	111	151	190
43	Repair shop	27	38	26	33	32	35	49	30	44	30	68	60	53	81	69	60	111	87	139	192
44	Vehicle service/repair shop	35	49	33	42	40	45	62	39	56	38	87	76	68	104	88	77	142	111	178	246
45	Vehicle storage/ maintenance	26	36	25	31	30	34	46	29	42	28	65	57	51	77	66	57	106	83	133	183
46	Other service	37	52	36	45	43	49	67	42	61	41	94	82	74	112	95	83	153	120	192	265
47	Strip shopping mall	214	216	182	168	151	142	152	114	148	116	173	162	154	175	157	166	207	177	238	307
48	Enclosed mall	129	130	110	101	91	85	92	69	89	70	104	98	92	105	95	100	124	106	143	185
49	Bar/pub/lounge	245	238	219	193	186	179	182	163	184	159	200	198	189	190	179	200	209	188	228	272
50	Courthouse/probation office	218	213	190	164	162	139	147	127	138	124	153	140	134	131	121	125	147	125	158	191

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Table 7-3a Building Activity Source Energy Use Intensity Targets (EUI_{t1}) (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 *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

Table 7-3b Building Activity Source Energy Use Intensity Targets (EUI_{t1}) (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	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 7-3b Building Activity Source Energy Use Intensity Targets (EUI_{t1}) (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
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

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Table 7-3b Building Activity Source Energy Use Intensity Targets (EUI_{t1}) (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
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/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	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

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Comment on Chapters 4-6: https://odoe.powerappsportals.us/en-US/bps-5-22-2024/

Table 7-4a Building Activity Greenhouse Gas Intensity (GHGI) Targets (I-P)

		GHG Intensity by Building Type by Climate Zone (lb $CO_2e/ft^2 \cdot yr$) 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	12.7	12.9	10.9	11.9	10.8	10.2	10.3	9.8	7.8	8.8	10.2	9.6	9.1	10.0	9.7	8.8	10.8	10.1	11.4	12.8
2	Bank/other financial	23.3	23.7	20.1	21.9	19.9	18.8	18.9	17.9	14.3	16.3	18.8	17.7	16.7	18.3	17.9	16.2	19.8	18.6	21.0	23.5
3	Government office	15.7	16.0	13.5	14.7	13.4	12.6	12.7	12.1	9.6	10.9	12.6	11.9	11.2	12.3	12.0	10.9	13.3	12.5	14.1	15.8
4	Medical office (nondiagnostic)	13.0	13.2	11.2	12.2	11.1	10.5	10.6	10.0	8.0	9.1	10.5	9.9	9.3	10.2	10.0	9.0	11.1	10.4	11.7	13.1
5	Mixed-use office	11.8	12.0	10.2	11.1	10.1	9.5	9.6	9.1	7.2	8.2	9.5	9.0	8.5	9.3	9.1	8.2	10.1	9.4	10.6	11.9
6	Other office	9.7	9.8	8.3	9.1	8.3	7.8	7.9	7.4	5.9	6.7	7.8	7.3	6.9	7.6	7.4	6.7	8.2	7.7	8.7	9.7
7	Laboratory	34.5	34.0	29.4	31.9	28.9	27.1	27.5	26.2	21.2	23.6	27.4	26.1	24.6	27.4	26.6	24.3	29.8	28.0	31.6	35.6
8	Distribution/shipping center	3.6	4.9	3.4	4.6	4.2	4.7	5.7	5.2	2.5	4.1	7.2	6.3	5.9	8.9	8.0	6.4	11.4	9.8	13.9	17.9
9	Nonrefrigerated warehouse	2.3	3.1	2.2	2.9	2.7	3.0	3.6	3.3	1.6	2.6	4.6	4.0	3.8	5.7	5.1	4.1	7.3	6.2	8.8	11.4
10	Convenience store	53.3	52.8	48.2	51.1	50.0	46.5	50.2	47.9	41.5	45.1	51.4	48.2	48.4	52.8	50.6	49.3	56.5	53.4	59.5	65.0
11	Convenience store with gas	62.0	61.4	56.1	59.4	58.1	54.1	58.4	55.7	48.3	52.4	59.8	56.1	56.3	61.4	58.8	57.3	65.7	62.1	69.2	75.6
12	Grocery store/food market	41.8	41.4	37.8	40.1	39.2	36.5	39.4	37.6	32.6	35.4	40.3	37.8	37.9	41.4	39.7	38.7	44.3	41.9	46.7	51.0
13	Other food sales	44.7	44.2	40.4	42.8	41.9	39.0	42.1	40.2	34.8	37.8	43.1	40.4	40.6	44.3	42.4	41.3	47.4	44.7	49.9	54.5
14	Fire station/police station	13.1	12.9	11.1	12.1	10.9	10.3	10.4	9.9	8.0	8.9	10.4	9.9	9.3	10.4	10.1	9.2	11.3	10.6	12.0	13.5
15	Other public order and safety	35.1	34.7	30.0	32.5	29.4	27.7	28.0	26.7	21.6	24.1	28.0	26.5	25.1	28.0	27.1	24.8	30.4	28.6	32.2	36.3
16	Medical office (diagnostic)	12.2	11.8	11.2	11.4	10.7	10.8	10.5	10.5	8.6	9.0	10.3	10.4	9.1	10.0	10.3	8.7	10.6	10.6	10.8	11.5
17	Clinic/other outpatient health	14.7	14.2	13.5	13.8	12.9	13.0	12.7	12.7	10.4	10.8	12.4	12.5	11.0	12.1	12.5	10.5	12.8	12.8	13.1	13.9
18	Refrigerated warehouse	25.4	25.1	21.6	23.5	21.3	20.0	20.2	19.3	15.6	17.4	20.2	19.2	18.1	20.2	19.6	17.9	22.0	20.6	23.3	26.2
19	Religious worship	6.1	6.1	5.2	5.7	5.1	4.8	4.9	4.7	3.8	4.2	4.9	4.6	4.4	4.9	4.7	4.3	5.3	5.0	5.6	6.4
20	Entertainment/culture	9.2	9.1	7.9	8.5	7.7	7.3	7.4	7.0	5.7	6.3	7.3	7.0	6.6	7.3	7.1	6.5	8.0	7.5	8.5	9.5
21	Library	15.7	15.5	13.4	14.5	13.2	12.4	12.5	11.9	9.6	10.8	12.5	11.9	11.2	12.5	12.1	11.1	13.6	12.8	14.4	16.2
22	Recreation	12.4	12.2	10.6	11.5	10.4	9.8	9.9	9.4	7.6	8.5	9.9	9.4	8.8	9.9	9.6	8.7	10.7	10.1	11.4	12.8
23	Social/meeting	10.5	10.4	9.0	9.7	8.8	8.3	8.4	8.0	6.5	7.2	8.4	7.9	7.5	8.4	8.1	7.4	9.1	8.5	9.6	10.9
24	Other public assembly	11.6	11.5	9.9	10.8	9.7	9.2	9.3	8.8	7.2	8.0	9.3	8.8	8.3	9.3	9.0	8.2	10.1	9.5	10.7	12.0
25	College/university	28.2	26.3	21.0	24.6	20.3	18.6	18.4	17.4	11.6	14.6	18.7	17.2	16.3	19.1	17.8	16.4	21.4	19.3	23.3	27.9

Table 7-4a Building Activity Greenhouse Gas Intensity (GHGI) Targets (I-P) *(Continued)*

		GHG Intensity by Building Type by Climate Zone (lb $CO_2e/ft^2 \cdot yr$)																		
		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	11.9	11.6	9.8	10.9	9.4	9.0	8.8	8.5	7.0	7.7	8.8	8.4	7.9	8.8	8.5	7.8	9.5	8.9	10.2	11.9
27	High school	18.8	17.6	14.0	16.4	13.6	12.5	12.3	11.6	7.7	9.8	12.5	11.5	10.9	12.8	11.9	10.9	14.3	12.9	15.6	18.7
28	Preschool/daycare	15.9	15.5	13.1	14.6	12.7	12.1	11.9	11.3	9.4	10.3	11.9	11.3	10.7	11.8	11.4	10.5	12.7	11.9	13.6	16.0
29	Other classroom education	9.6	9.4	7.9	8.8	7.6	7.3	7.2	6.8	5.7	6.2	7.1	6.8	6.4	7.1	6.9	6.3	7.7	7.2	8.2	9.6
30	Fast food	87.5	85.8	78.4	83.2	78.7	78.0	78.6	77.0	64.2	71.8	81.7	78.3	77.3	85.1	81.8	79.0	91.1	86.4	96.8	107.7
31	Restaurant/cafeteria	56.1	54.2	48.5	52.4	48.0	47.0	47.7	46.4	37.9	42.6	49.6	48.4	46.8	51.3	49.5	48.0	54.1	52.1	57.4	64.4
32	Other food service	23.8	23.0	20.6	22.3	20.4	19.9	20.3	19.7	16.1	18.1	21.0	20.5	19.9	21.8	21.0	20.4	23.0	22.1	24.4	27.3
33	Hospital/inpatient health	48.2	48.2	43.8	45.7	45.3	40.5	43.0	40.4	39.6	39.9	42.3	39.7	38.8	40.1	38.7	36.9	41.2	39.5	41.3	42.0
34	Nursing home/assisted living	26.4	26.4	20.0	23.8	19.3	18.7	19.1	18.1	10.7	14.4	21.1	18.7	18.7	22.6	20.4	19.7	25.5	22.9	28.2	33.1
35	Dormitory/fraternity/sorority	13.3	13.2	10.0	11.9	9.7	9.4	9.6	9.1	5.4	7.2	10.6	9.4	9.4	11.3	10.2	9.9	12.8	11.5	14.1	16.6
36	Hotel	16.8	15.9	14.3	14.9	14.4	13.0	13.5	12.8	11.5	12.0	13.7	12.9	12.5	13.8	13.4	12.7	14.7	13.9	15.4	16.7
37	Motel or inn	15.9	15.6	14.1	14.6	13.4	12.8	12.4	12.2	10.8	11.5	12.2	11.9	11.2	12.2	11.9	11.1	13.0	12.2	13.5	14.7
38	Other lodging	17.1	16.8	15.1	15.7	14.4	13.7	13.3	13.1	11.6	12.4	13.0	12.7	12.0	13.1	12.8	11.9	14.0	13.1	14.5	15.7
39	Vehicle dealership/showroom	13.0	13.1	11.0	12.2	11.0	10.3	10.9	10.2	7.1	8.8	11.1	10.5	9.9	11.8	11.3	10.2	13.5	12.6	14.8	17.4
40	Retail store	12.4	12.4	10.5	11.6	10.5	9.8	10.4	9.7	6.8	8.3	10.6	9.9	9.4	11.2	10.7	9.7	12.8	11.9	14.1	16.6
41	Other retail	17.4	17.5	14.7	16.3	14.7	13.8	14.6	13.6	9.5	11.7	14.9	14.0	13.2	15.8	15.1	13.7	18.0	16.8	19.9	23.3
42	Post office/postal center	16.6	16.6	12.6	15.0	12.1	11.7	12.0	11.4	6.7	9.1	13.3	11.8	11.8	14.2	12.8	12.4	16.0	14.4	17.7	20.8
43	Repair shop	4.3	5.9	4.1	5.6	5.1	5.7	6.9	6.3	3.1	4.9	8.7	7.6	7.1	10.8	9.6	7.7	13.8	11.9	16.8	21.6
44	Vehicle service/repair shop	5.5	7.6	5.2	7.1	6.5	7.2	8.8	8.0	3.9	6.2	11.0	9.6	9.1	13.7	12.2	9.8	17.6	15.1	21.4	27.5
45	Vehicle storage/maintenance	3.8	5.3	3.7	5.0	4.6	5.1	6.2	5.7	2.7	4.4	7.8	6.8	6.4	9.6	8.6	6.9	12.4	10.6	15.0	19.4
46	Other service	5.6	7.7	5.3	7.3	6.6	7.4	9.0	8.2	4.0	6.4	11.3	9.8	9.3	14.0	12.5	10.0	18.0	15.4	21.9	28.2
47	Strip shopping mall	25.7	25.9	21.9	24.2	21.0	19.9	20.7	19.5	14.3	17.1	21.2	19.9	19.2	22.5	21.3	19.7	25.3	23.5	27.8	33.1
48	Enclosed mall	17.8	18.0	15.2	16.8	14.5	13.8	14.4	13.5	9.9	11.9	14.7	13.8	13.3	15.6	14.8	13.6	17.6	16.3	19.3	22.9
49	Bar/pub/lounge	27.7	26.8	24.0	25.9	23.7	23.2	23.6	22.9	18.7	21.0	24.5	23.9	23.1	25.4	24.5	23.7	26.7	25.8	28.4	31.8
50	Courthouse/probation office	23.1	22.5	20.0	21.0	20.2	17.7	19.0	17.2	15.5	16.8	19.0	16.8	16.5	17.6	16.7	15.7	18.6	17.2	19.2	20.7

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Table 7-4a Building Activity Greenhouse Gas Intensity (GHGI) Targets (I-P) *(Continued)*

		GHG Intensity by Building Type by Climate Zone (lb $CO_2e/ft^2 \cdot yr$)																		
		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	14.1	14.1	10.7	12.7	10.3	9.9	10.2	9.6	5.7	7.7	11.2	9.9	10.0	12.0	10.8	49.0	13.6	12.2	15.0	17.6
52	Single-family detached	10.2	10.2	7.7	9.2	7.4	7.2	7.4	7.0	4.1	5.6	8.1	7.2	7.2	8.7	7.9	36.0	9.8	8.8	10.8	12.8
53	Single-family attached	10.1	10.1	7.7	9.1	7.4	7.1	7.3	6.9	4.1	5.5	8.1	7.2	7.2	8.6	7.8	42.0	9.8	8.8	10.8	12.7
54	Apartment (in 2 to 4 unit *building*)	11.3	11.3	8.5	10.1	8.2	8.0	8.2	7.7	4.6	6.2	9.0	8.0	8.0	9.6	8.7	61.0	10.9	9.8	12.0	14.1
55	Apartment (in 5+ unit *building*)	9.8	9.8	7.4	8.8	7.2	6.9	7.1	6.7	4.0	5.4	7.8	6.9	6.9	8.4	7.6	42.0	9.5	8.5	10.5	12.3

* ***Informative Note:*** Values in Table 7-4a for all Residential Building Types in Climate Zone 5C include an error in calculation and are approximately four times higher than they should be. An addendum will be issued to correct these values.

Table 7-4b Building Activity Greenhouse Gas Intensity (GHGI) Targets (SI)

		GHG Intensity by Building Type by Climate Zone (kg $CO_2e/m^2 \cdot yr$) 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	62	63	53	58	53	50	50	48	38	43	50	47	44	49	48	43	53	49	56	62
2	Bank/other financial	114	116	98	107	98	92	93	88	70	80	92	87	82	90	88	79	97	91	103	115
3	Government office	77	78	66	72	66	62	62	59	47	53	62	58	55	60	59	53	65	61	69	77
4	Medical office (nondiagnostic)	64	65	55	60	54	51	52	49	39	44	51	48	45	50	49	44	54	51	57	64
5	Mixed-use office	58	59	50	54	49	47	47	44	35	40	47	44	41	45	44	40	49	46	52	58
6	Other office	47	48	41	45	40	38	38	36	29	33	38	36	34	37	36	33	40	38	43	48
7	Laboratory	169	166	144	156	141	133	134	128	104	116	134	127	120	134	130	119	146	137	155	174
8	Distribution/shipping center	17	24	17	23	21	23	28	26	12	20	35	31	29	44	39	31	56	48	68	88
9	Nonrefrigerated warehouse	11	15	11	14	13	15	18	16	8	13	22	19	18	28	25	20	36	31	43	56
10	Convenience store	261	258	236	250	245	228	246	234	203	221	252	236	237	258	247	241	276	261	291	318
11	Convenience store with gas	303	300	274	291	284	265	286	273	236	257	292	274	275	300	288	281	321	304	339	370
12	Grocery store/food market	205	202	185	196	192	179	193	184	159	173	197	185	186	203	194	189	217	205	229	250
13	Other food sales	219	216	198	210	205	191	206	197	170	185	211	198	198	217	207	202	232	219	244	267
14	Fire station/police station	64	63	54	59	53	50	51	48	39	44	51	48	46	51	49	45	55	52	59	66

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Table 7-4b Building Activity Greenhouse Gas Intensity (GHGI) Targets (SI) *(Continued)*

		GHG Intensity by Building Type by Climate Zone (kg $CO_2e/m^2 \cdot yr$) 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**
15	Other public order and safety	172	170	147	159	144	135	137	131	106	118	137	130	123	137	133	121	149	140	158	178
16	Medical office (diagnostic)	60	58	55	56	52	53	51	51	42	44	50	51	45	49	51	43	52	52	53	56
17	Clinic/other outpatient health	72	70	66	67	63	63	62	62	51	53	61	61	54	59	61	51	62	63	64	68
18	Refrigerated warehouse	124	123	106	115	104	98	99	94	76	85	99	94	89	99	96	88	107	101	114	128
19	Religious worship	30	30	26	28	25	24	24	23	18	21	24	23	21	24	23	21	26	24	28	31
20	Entertainment/culture	45	45	38	42	38	36	36	34	28	31	36	34	32	36	35	32	39	37	41	47
21	Library	77	76	66	71	64	60	61	58	47	53	61	58	55	61	59	54	66	62	70	79
22	Recreation	61	60	52	56	51	48	48	46	37	42	48	46	43	48	47	43	52	49	56	63
23	Social/meeting	51	51	44	48	43	40	41	39	32	35	41	39	37	41	40	36	45	42	47	53
24	Other public assembly	57	56	49	53	48	45	45	43	35	39	45	43	41	45	44	40	49	46	52	59
25	College/university	138	129	103	120	99	91	90	85	57	71	92	84	80	94	87	80	105	94	114	136
26	Elementary/middle school	58	57	48	53	46	44	43	41	34	38	43	41	39	43	42	38	47	44	50	58
27	High school	92	86	69	80	66	61	60	57	38	48	61	56	53	63	58	54	70	63	76	91
28	Preschool/daycare	78	76	64	72	62	59	58	56	46	50	58	55	52	58	56	51	62	58	67	78
29	Other classroom education	47	46	39	43	37	36	35	33	28	30	35	33	31	35	34	31	38	35	40	47
30	Fast food	428	420	383	407	385	382	385	377	314	351	400	383	378	416	400	387	446	423	474	527
31	Restaurant/cafeteria	274	265	238	257	235	230	234	227	186	208	243	237	229	251	242	235	265	255	281	315
32	Other food service	116	112	101	109	100	98	99	96	79	88	103	100	97	107	103	100	112	108	119	134
33	Hospital/inpatient health	236	236	215	224	221	198	210	198	194	195	207	194	190	196	189	180	202	193	202	205
34	Nursing home/assisted living	129	129	98	116	94	91	94	89	52	71	103	92	92	110	100	96	125	112	138	162
35	Dormitory/fraternity/sorority	65	65	49	58	47	46	47	44	26	35	52	46	46	55	50	48	62	56	69	81
36	Hotel	82	78	70	73	70	64	66	63	56	59	67	63	61	68	65	62	72	68	76	82
37	Motel or inn	78	76	69	72	66	63	61	60	53	56	59	58	55	60	58	54	64	60	66	72
38	Other lodging	83	82	74	77	70	67	65	64	57	61	64	62	59	64	63	58	68	64	71	77
39	Vehicle dealership/ showroom	64	64	54	60	54	50	53	50	35	43	54	51	48	58	55	50	66	61	73	85

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Table 7-4b Building Activity Greenhouse Gas Intensity (GHGI) Targets (SI) *(Continued)*

		GHG Intensity by Building Type by Climate Zone (kg $CO_2e/m^2 \cdot yr$)																		
		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
40	Retail store	61	61	51	57	51	48	51	47	33	41	52	49	46	55	52	48	63	58	69	81
41	Other retail	85	86	72	80	72	68	72	67	47	57	73	69	65	77	74	67	88	82	97	114
42	Post office/postal center	81	81	62	73	59	57	59	56	33	44	65	58	58	69	63	61	78	70	87	102
43	Repair shop	21	29	20	27	25	28	34	31	15	24	42	37	35	53	47	38	68	58	82	106
44	Vehicle service/repair shop	27	37	25	35	32	35	43	39	19	30	54	47	44	67	60	48	86	74	105	135
45	Vehicle storage/maintenance	19	26	18	24	22	25	30	28	13	21	38	33	31	47	42	34	61	52	74	95
46	Other service	27	38	26	35	32	36	44	40	19	31	55	48	45	69	61	49	88	76	107	138
47	Strip shopping mall	126	127	107	119	103	97	101	95	70	84	104	97	94	110	104	96	124	115	136	162
48	Enclosed mall	87	88	74	82	71	68	70	66	49	58	72	68	65	76	72	67	86	80	94	112
49	Bar/pub/lounge	136	131	117	127	116	114	115	112	92	103	120	117	113	124	120	116	131	126	139	156
50	Courthouse/probation office	113	110	98	103	99	87	93	84	76	82	93	82	81	86	82	77	91	84	94	101
		GHG Intensity by Building Type by Climate Zone (kg $CO_2e/m^2 \cdot yr$)																		
		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	69	69	52	62	50	49	50	47	28	38	55	49	49	59	53	240	66	60	73	86
52	Single-family detached	50	50	38	45	36	35	36	34	20	27	40	35	35	43	38	176	48	43	53	62
53	Single-family attached	50	50	38	45	36	35	36	34	20	27	40	35	35	42	38	205	48	43	53	62
54	Apartment (in 2 to 4 unit *building*)	55	55	42	50	40	39	40	38	22	30	44	39	39	47	43	298	53	48	59	69
55	Apartment (in 5+ unit *building*)	48	48	36	43	35	34	35	33	19	26	38	34	34	41	37	205	46	42	51	60

* ***Informative Note:*** Values in Table 7-4b for all *residential building* types in Climate Zone 5C include an error in calculation and are approximately four times higher than they should be. An addendum will be issued to correct these values.

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Table 7-5a Building Activity Electricity Site Energy Use Intensity Targets (EUI_{tt}) (I-P)

		Electricity Site Energy Use 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	44	44	38	29	27	24	23	20	24	18	23	24	20	17	17	20	20	16	22	28
2	Bank/other financial	74	75	64	49	46	41	39	34	40	31	39	41	34	30	29	34	34	28	37	47
3	Government office	48	49	42	32	30	27	25	22	26	20	26	27	22	19	19	22	22	18	24	31
4	Medical office (nondiagnostic)	43	44	37	28	27	24	22	20	23	18	23	24	20	17	17	19	20	16	21	27
5	Mixed-use office	38	39	33	25	24	21	20	18	21	16	20	21	18	15	15	17	18	14	19	24
6	Other office	37	37	32	24	23	20	19	17	20	15	19	20	17	15	14	17	17	14	18	23
7	Laboratory	125	124	109	82	79	70	67	61	70	54	70	73	62	55	53	63	62	51	68	87
8	Distribution/shipping center	8	12	8	8	8	9	12	8	11	7	16	15	13	16	14	14	22	17	28	39
9	Nonrefrigerated warehouse	5	7	5	5	5	5	7	5	7	4	10	9	8	10	9	9	13	10	17	24
10	Convenience store	145	145	132	99	103	92	94	93	99	80	100	105	95	80	78	100	88	75	96	118
11	Convenience store with gas	164	163	149	112	116	104	105	104	112	90	113	118	107	90	87	113	100	84	108	133
12	Grocery store/food market	132	131	120	90	93	84	85	84	90	72	91	95	86	73	70	91	80	68	87	107
13	Other food sales	145	144	131	99	102	92	93	92	98	79	100	104	94	80	77	99	88	74	95	118
14	Fire station/police station	45	45	39	30	28	25	24	22	26	20	25	27	23	20	19	23	22	19	25	31
15	Other public order and safety	95	94	82	62	60	53	51	46	54	41	53	56	47	41	40	48	47	39	51	66
16	Medical office (diagnostic)	43	41	41	28	28	27	24	25	27	20	24	27	21	17	18	20	19	17	19	22
17	Clinic/other outpatient health	48	45	46	31	31	30	27	27	30	22	26	30	24	20	21	23	21	19	21	25
18	Refrigerated warehouse	68	67	59	44	42	38	36	33	38	29	38	40	34	29	29	34	33	28	36	47
19	Religious worship	23	22	20	15	14	13	12	11	13	10	13	13	11	10	10	11	11	9	12	16
20	Entertainment/culture	36	35	31	23	22	20	19	17	20	16	20	21	18	16	15	18	18	15	19	25
21	Library	56	56	49	37	35	31	30	27	32	24	31	33	28	24	24	28	28	23	30	39
22	Recreation	41	40	35	27	26	23	22	20	23	18	23	24	20	18	17	21	20	17	22	28
23	Social/meeting	38	37	33	25	24	21	20	18	21	16	21	22	19	16	16	19	19	15	20	26
24	Other public assembly	45	45	39	30	28	25	24	22	25	20	25	26	22	20	19	23	22	19	24	31
25	College/university	79	74	59	49	43	38	37	29	38	27	42	41	36	34	31	37	41	32	46	64

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Table 7-5a Building Activity Electricity Site Energy Use Intensity Targets (EUI_{ti}) (I-P) *(Continued)*

		Electricity Site Energy Use 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	39	38	32	25	23	21	20	18	21	16	21	22	19	16	16	18	19	16	21	29
27	High school	57	54	43	35	31	27	27	21	27	19	30	29	26	25	22	27	29	23	33	46
28	Preschool/daycare	54	53	45	35	32	29	28	25	29	22	29	31	26	23	22	26	26	22	29	40
29	Other classroom education	33	32	27	21	19	18	17	15	17	13	18	19	16	14	13	16	16	13	18	24
30	Fast food	286	282	264	193	194	183	172	168	186	150	184	196	172	148	144	180	163	138	177	220
31	Restaurant/cafeteria	205	199	184	137	135	126	121	115	130	104	131	140	124	105	102	131	115	98	125	155
32	Other food service	72	70	64	48	47	44	42	40	46	36	46	49	43	37	36	46	40	34	44	54
33	Hospital/inpatient health	181	185	169	123	128	107	105	106	109	95	103	108	96	73	72	91	76	66	78	88
34	Nursing home/assisted living	78	78	60	52	46	43	46	36	46	31	56	53	50	47	42	54	55	44	63	83
35	Dormitory/ fraternity/sorority	41	41	32	27	24	22	24	19	24	16	29	28	26	25	22	29	29	23	33	43
36	Hotel	48	46	43	31	32	28	28	29	29	24	30	31	28	24	23	29	26	22	28	34
37	Motel or inn	51	50	46	33	32	29	25	26	28	23	25	28	23	19	19	23	20	17	21	25
38	Other lodging	61	60	54	39	38	34	30	31	33	27	30	33	27	22	23	27	24	21	25	29
39	Vehicle dealership/ showroom	43	44	37	29	27	25	25	20	26	19	28	29	25	24	23	27	28	23	32	44
40	Retail store	36	36	30	24	23	20	21	17	22	15	23	24	21	20	19	22	24	19	27	36
41	Other retail	50	51	43	33	32	29	30	24	30	22	33	33	29	28	26	31	33	27	38	51
42	Post office/postal center	44	45	34	30	26	24	26	21	26	18	32	30	28	27	24	31	32	25	36	47
43	Repair shop	10	14	9	10	10	11	14	9	14	8	20	18	15	20	17	17	27	20	33	48
44	Vehicle service/repair shop	13	18	12	13	13	14	18	12	17	11	25	23	19	25	22	22	34	25	43	61
45	Vehicle storage/ maintenance	9	13	9	10	10	10	13	9	13	8	19	17	15	19	16	16	25	19	32	45
46	Other service	14	19	13	14	14	15	19	13	19	12	27	25	21	27	24	24	37	27	46	66
47	Strip shopping mall	78	79	67	52	48	44	44	35	46	33	49	50	44	42	39	47	50	40	57	76
48	Enclosed mall	47	48	40	31	29	26	27	21	27	20	30	30	26	25	24	28	30	24	34	46
49	Bar/pub/lounge	89	87	80	60	59	55	53	50	57	45	57	61	54	46	45	57	50	43	54	67
50	Courthouse/probation office	80	78	69	51	51	43	43	39	43	35	44	43	38	32	30	36	35	29	38	47

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Table 7-5a Building Activity Electricity Site Energy Use Intensity Targets (EUI_{t1}) (I-P) *(Continued)*

		Electricity Site Energy Use 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	37	37	29	25	22	20	22	17	22	15	27	25	24	23	20	29	27	21	30	40
52	Single-family detached	32	32	25	21	19	17	19	15	19	13	23	21	20	19	17	21	23	18	26	34
53	Single-family attached	30	30	23	20	17	16	17	14	18	12	21	20	19	18	16	25	21	17	24	31
54	Apartment (in 2 to 4 unit *building*)	35	35	27	23	20	19	20	16	20	14	25	23	22	21	19	36	25	20	28	37
55	Apartment (in 5+ unit *building*)	27	28	21	18	16	15	16	13	16	11	20	19	18	17	15	25	20	16	22	29

Table 7-5b Building Activity Electricity Site Energy Use Intensity Targets (EUI_{t1}) (SI)

		Electricity Site Energy Use 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	494	503	427	325	308	275	257	228	268	207	261	274	229	198	195	224	225	185	245	313
2	Bank/other financial	843	857	727	554	526	468	438	388	458	353	445	467	390	338	333	381	384	315	418	534
3	Government office	550	559	475	361	343	306	286	253	299	230	291	305	254	221	217	249	250	206	273	349
4	Medical office (nondiagnostic)	488	497	421	321	305	271	254	225	265	205	258	271	226	196	193	221	222	183	242	310
5	Mixed-use office	437	444	377	287	273	243	227	201	237	183	231	242	202	175	172	198	199	163	217	277
6	Other office	415	422	358	273	259	230	215	191	225	174	219	230	192	166	164	188	189	155	206	263
7	Laboratory	1424	1409	1233	932	892	798	762	694	801	618	794	833	709	620	604	715	702	585	767	983
8	Distribution/shipping center	93	131	89	96	94	102	132	88	127	80	184	172	143	184	162	161	251	188	314	448
9	Nonrefrigerated warehouse	56	79	54	58	57	62	80	53	77	48	111	104	86	111	97	97	151	113	189	270
10	Convenience store	1652	1645	1499	1127	1169	1049	1062	1052	1124	906	1141	1193	1079	910	881	1135	1003	847	1086	1344
11	Convenience store with gas	1862	1854	1690	1271	1318	1182	1197	1186	1267	1022	1286	1344	1216	1026	993	1279	1130	955	1224	1515
12	Grocery store/food market	1497	1491	1359	1022	1060	951	963	954	1019	822	1034	1081	978	825	799	1029	909	768	984	1218
13	Other food sales	1641	1634	1490	1120	1162	1042	1055	1046	1117	901	1134	1185	1072	905	875	1128	996	842	1079	1335
14	Fire station/police station	517	511	447	338	324	289	276	252	290	224	288	302	257	225	219	259	255	212	278	357
15	Other public order and safety	1082	1070	937	708	678	606	579	527	608	469	603	632	538	471	459	543	533	444	583	747

Table 7-5b Building Activity Electricity Site Energy Use Intensity Targets (EUI_{t1}) (SI) *(Continued)*

		Electricity Site Energy Use 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
16	Medical office (diagnostic)	489	462	470	321	318	306	274	279	306	225	269	305	239	199	210	230	213	194	218	253
17	Clinic/other outpatient health	546	516	524	358	354	341	306	312	341	251	300	340	267	222	234	257	238	216	243	282
18	Refrigerated warehouse	768	760	665	503	481	430	411	374	432	333	428	449	382	335	326	385	378	315	414	530
19	Religious worship	256	254	222	168	161	144	137	125	144	111	143	150	128	112	109	129	126	105	138	177
20	Entertainment/culture	407	403	353	267	255	228	218	198	229	177	227	238	203	177	173	204	201	167	219	281
21	Library	638	631	552	417	399	357	341	311	358	277	355	373	317	278	270	320	314	262	343	440
22	Recreation	464	459	402	304	291	260	248	226	261	201	259	271	231	202	197	233	229	190	250	320
23	Social/meeting	426	422	369	279	267	239	228	208	240	185	238	249	212	186	181	214	210	175	230	294
24	Other public assembly	513	507	444	335	321	287	274	250	288	222	286	300	255	223	217	257	253	210	276	354
25	College/university	898	842	673	558	490	428	421	328	429	302	472	461	411	390	352	426	463	367	526	730
26	Elementary/middle school	442	432	366	288	262	238	225	200	235	179	239	250	211	187	181	209	214	177	240	329
27	High school	649	609	486	403	354	309	304	237	310	218	341	333	297	282	254	308	334	265	380	528
28	Preschool/daycare	616	602	510	402	366	331	314	279	328	250	333	348	295	260	252	291	298	247	334	459
29	Other classroom education	373	364	309	243	221	200	190	169	198	151	202	211	178	158	153	176	180	150	202	278
30	Fast food	3245	3199	2994	2196	2208	2077	1952	1912	2115	1705	2087	2231	1953	1679	1640	2041	1856	1571	2014	2502
31	Restaurant/cafeteria	2327	2265	2087	1560	1537	1436	1375	1306	1477	1181	1488	1588	1407	1193	1163	1484	1310	1117	1419	1756
32	Other food service	816	794	732	547	539	504	482	458	518	414	522	557	494	418	408	520	460	392	498	616
33	Hospital/inpatient health	2058	2097	1916	1400	1456	1219	1192	1207	1236	1083	1170	1228	1096	830	815	1031	868	751	882	999
34	Nursing home/assisted living	884	887	685	586	517	485	517	412	524	354	631	599	566	537	480	619	630	504	715	938
35	Dormitory/ fraternity/sorority	463	464	358	307	271	254	271	216	274	185	330	314	296	281	251	324	330	264	374	491
36	Hotel	542	517	484	351	366	319	317	326	333	274	337	357	313	267	265	327	295	252	317	386
37	Motel or inn	576	567	517	374	360	327	288	296	317	261	281	314	261	213	217	262	229	196	238	279
38	Other lodging	687	676	617	446	430	390	343	353	378	311	335	375	311	254	259	312	273	234	284	333
39	Vehicle dealership/ showroom	493	495	416	326	311	281	289	231	296	211	322	327	282	272	256	307	323	262	369	495
40	Retail store	408	411	345	270	258	233	240	191	245	175	267	271	233	226	213	254	268	217	306	410

Table 7-5b Building Activity Electricity Site Energy Use Intensity Targets (EUI_{t1}) (SI) *(Continued)*

		Electricity Site Energy Use 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	573	576	484	379	362	326	337	268	344	246	374	380	328	317	298	357	376	305	429	576
42	Post office/postal center	505	507	391	335	295	277	295	235	299	202	361	342	323	307	274	353	360	288	408	536
43	Repair shop	112	158	108	115	113	123	160	106	153	96	222	208	173	222	195	194	303	226	378	541
44	Vehicle service/repair shop	144	202	137	148	145	158	204	135	196	123	284	266	221	284	250	248	388	289	484	691
45	Vehicle storage/ maintenance	107	151	103	110	108	118	152	101	146	92	212	198	165	212	186	186	289	216	361	516
46	Other service	155	218	148	159	156	170	220	146	212	133	306	287	238	306	269	268	418	312	522	746
47	Strip shopping mall	888	897	755	592	542	495	501	399	517	377	562	567	498	478	445	538	565	459	646	865
48	Enclosed mall	534	540	454	356	326	298	301	240	311	227	338	341	300	288	268	323	340	276	389	521
49	Bar/pub/lounge	1014	987	910	680	670	626	599	569	644	514	649	692	613	520	507	647	571	487	619	765
50	Courthouse/probation office	904	885	786	580	583	484	484	442	483	401	497	489	436	358	341	406	401	324	430	537

		Electricity Site Energy Use 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	424	425	328	281	248	232	248	198	251	170	303	287	271	258	230	327	302	241	343	450
52	Single-family detached	360	361	279	239	210	197	210	168	213	144	257	244	230	219	196	240	256	205	291	382
53	Single-family attached	336	337	260	223	196	184	196	157	199	135	240	228	215	204	183	280	239	191	272	356
54	Apartment (in 2 to 4 unit *building*)	392	393	303	260	229	215	229	183	232	157	280	266	251	238	213	407	279	223	317	416
55	Apartment (in 5+ unit *building*)	312	313	242	207	182	171	182	145	185	125	223	211	200	190	170	280	222	178	252	331

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Table 7-6a Building Activity Fossil-Fuel Site Energy Use Intensity Targets ($FEUI_{tt}$) (I-P)

		Fossil-Fuel Site Energy Use 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	0	0	0	13	10	11	15	9	11	13	16	11	14	23	20	14	26	24	29	33
2	Bank/other financial	0	0	0	21	18	19	25	16	19	22	27	19	24	39	34	24	44	42	49	56
3	Government office	0	0	0	14	12	13	17	10	12	14	18	13	16	25	22	15	29	27	32	36
4	Medical office (nondiagnostic)	0	0	0	12	10	11	15	9	11	13	16	11	14	22	20	14	25	24	28	32
5	Mixed-use office	0	0	0	11	9	10	13	8	10	11	14	10	12	20	18	12	23	22	25	29
6	Other office	0	0	0	11	9	10	12	8	9	11	13	10	12	19	17	12	22	21	24	27
7	Laboratory	0	0	0	36	30	33	44	29	33	38	49	34	44	71	63	44	80	77	90	103
8	Distribution/shipping center	0	0	0	4	3	4	8	4	5	5	11	7	9	21	17	10	29	25	37	47
9	Nonrefrigerated warehouse	0	0	0	2	2	3	5	2	3	3	7	4	5	13	10	6	17	15	22	28
10	Convenience store	0	0	0	43	40	43	61	44	47	56	70	49	67	104	91	70	114	112	127	140
11	Convenience store with gas	0	0	0	49	45	49	69	49	52	63	79	56	75	117	103	79	129	126	143	158
12	Grocery store/food market	0	0	0	39	36	39	56	39	42	51	64	45	60	94	83	64	104	101	115	127
13	Other food sales	0	0	0	43	39	43	61	43	46	56	70	49	66	103	91	70	114	111	126	140
14	Fire station/police station	0	0	0	13	11	12	16	10	12	14	18	12	16	26	23	16	29	28	32	37
15	Other public order and safety	0	0	0	27	23	25	33	22	25	29	37	26	33	54	48	34	61	59	68	78
16	Medical office (diagnostic)	0	0	0	12	11	13	16	12	13	14	17	13	15	23	22	14	24	26	25	26
17	Clinic/other outpatient health	0	0	0	14	12	14	18	13	14	16	18	14	17	25	24	16	27	29	28	29
18	Refrigerated warehouse	0	0	0	19	16	18	24	15	18	21	26	19	24	38	34	24	43	42	48	55
19	Religious worship	0	0	0	6	5	6	8	5	6	7	9	6	8	13	11	8	14	14	16	18
20	Entertainment/culture	0	0	0	10	9	9	13	8	9	11	14	10	13	20	18	13	23	22	26	29
21	Library	0	0	0	16	14	15	20	13	15	17	22	15	20	32	28	20	36	35	40	46
22	Recreation	0	0	0	12	10	11	14	9	11	12	16	11	14	23	20	14	26	25	29	33
23	Social/meeting	0	0	0	11	9	10	13	9	10	11	15	10	13	21	19	13	24	23	27	31
24	Other public assembly	0	0	0	13	11	12	16	10	12	14	18	12	16	25	23	16	29	28	32	37
25	College/university	0	0	0	21	17	18	24	14	18	19	29	19	25	44	36	26	53	48	61	76

Table 7-6a Building Activity Fossil-Fuel Site Energy Use Intensity Targets ($FEUI_{tt}$) (I-P) *(Continued)*

		Fossil-Fuel Site Energy Use 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	0	0	0	11	9	10	13	8	10	11	15	10	13	21	19	13	24	23	28	34
27	High school	0	0	0	16	12	13	18	10	13	13	21	14	18	32	26	19	38	35	44	55
28	Preschool/daycare	0	0	0	15	12	14	18	12	14	15	20	14	18	30	26	18	34	33	39	48
29	Other classroom education	0	0	0	9	8	8	11	7	8	9	12	9	11	18	16	11	21	20	24	29
30	Fast food	0	0	0	85	75	86	113	79	87	105	128	92	121	191	170	126	212	207	235	261
31	Restaurant/cafeteria	0	0	0	60	52	59	80	54	61	73	92	66	87	136	120	92	149	148	166	184
32	Other food service	0	0	0	21	18	21	28	19	21	26	32	23	31	48	42	32	52	52	58	64
33	Hospital/inpatient health	0	0	0	54	50	50	69	50	51	67	72	51	68	95	84	64	99	99	103	104
34	Nursing home/assisted living	0	0	0	23	18	20	30	17	22	22	39	25	35	61	50	38	72	67	83	98
35	Dormitory/ fraternity/sorority	0	0	0	12	9	10	16	9	11	11	20	13	18	32	26	20	38	35	44	51
36	Hotel	0	0	0	14	12	13	18	13	14	17	21	15	19	30	27	20	34	33	37	40
37	Motel or inn	0	0	0	14	12	14	17	12	13	16	17	13	16	24	22	16	26	26	28	29
38	Other lodging	0	0	0	17	15	16	20	15	16	19	21	15	19	29	27	19	31	31	33	35
39	Vehicle dealership/ showroom	0	0	0	13	11	12	17	10	12	13	20	14	17	31	27	19	37	35	43	52
40	Retail store	0	0	0	10	9	10	14	8	10	11	16	11	14	26	22	16	31	29	36	43
41	Other retail	0	0	0	15	12	13	19	11	14	15	23	16	20	36	31	22	43	40	50	60
42	Post office/postal center	0	0	0	13	10	11	17	10	12	13	22	14	20	35	28	22	41	38	48	56
43	Repair shop	0	0	0	4	4	5	9	4	6	6	14	9	11	25	20	12	35	30	44	56
44	Vehicle service/repair shop	0	0	0	6	5	7	12	6	8	8	17	11	14	32	26	15	44	38	57	72
45	Vehicle storage/ maintenance	0	0	0	4	4	5	9	4	6	6	13	8	10	24	19	11	33	29	42	54
46	Other service	0	0	0	6	5	7	13	6	9	8	19	12	15	35	28	17	48	41	61	78
47	Strip shopping mall	0	0	0	23	18	20	29	17	21	23	35	23	31	55	46	33	64	61	75	90
48	Enclosed mall	0	0	0	14	11	12	17	10	13	14	21	14	19	33	28	20	39	36	45	54
49	Bar/pub/lounge	0	0	0	26	23	26	35	24	27	32	40	29	38	59	52	40	65	64	72	80
50	Courthouse/probation office	0	0	0	22	20	20	28	18	20	25	31	20	27	41	35	25	46	43	50	56

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Table 7-6a Building Activity Fossil-Fuel Site Energy Use Intensity Targets ($FEUI_{tt}$) (I-P) *(Continued)*

		Fossil-Fuel Site Energy Use 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	0	0	0	11	8	10	14	8	10	10	19	12	17	29	24	20	34	32	40	47
52	Single-family detached	0	0	0	9	7	8	12	7	9	9	16	10	14	25	20	15	29	27	34	40
53	Single-family attached	0	0	0	9	7	8	11	6	8	8	15	9	13	23	19	17	27	25	32	37
54	Apartment (in 2 to 4 unit *building*)	0	0	0	10	8	9	13	8	10	10	17	11	16	27	22	25	32	29	37	43
55	Apartment (in 5+ unit *building*)	0	0	0	8	6	7	11	6	8	8	14	9	12	22	18	17	25	23	29	35

Table 7-6b Building Activity Fossil-Fuel Site Energy Use Intensity Targets ($FEUI_{tt}$) (SI)

		Fossil-Fuel Site Energy Use 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	0	0	0	142	119	129	169	107	126	145	183	129	160	257	229	157	292	277	325	372
2	Bank/other financial	0	0	0	242	203	220	288	182	215	248	311	219	274	438	391	268	497	473	555	634
3	Government office	0	0	0	158	132	144	188	119	140	162	203	143	178	286	255	175	324	309	362	414
4	Medical office (nondiagnostic)	0	0	0	140	118	127	167	106	125	144	180	127	159	254	227	155	288	274	321	367
5	Mixed-use office	0	0	0	126	105	114	149	95	111	129	161	114	142	227	203	139	258	245	288	329
6	Other office	0	0	0	119	100	108	142	90	106	122	153	108	135	216	192	132	245	233	273	312
7	Laboratory	0	0	0	408	345	375	501	326	376	434	555	391	498	804	710	502	909	877	1018	1167
8	Distribution/shipping center	0	0	0	42	36	48	87	41	60	56	129	81	101	238	190	113	326	282	416	532
9	Nonrefrigerated warehouse	0	0	0	25	22	29	52	25	36	34	77	49	61	144	115	68	196	170	251	320
10	Convenience store	0	0	0	493	451	493	698	494	528	636	797	560	757	1180	1036	797	1299	1271	1440	1595
11	Convenience store with gas	0	0	0	556	509	555	786	557	595	717	898	632	854	1330	1168	898	1464	1432	1623	1798
12	Grocery store/food market	0	0	0	447	409	447	632	448	479	577	723	508	687	1069	939	722	1178	1152	1305	1446
13	Other food sales	0	0	0	490	449	490	693	491	525	632	792	557	753	1172	1029	792	1291	1263	1431	1585
14	Fire station/police station	0	0	0	148	125	136	182	118	136	157	201	142	181	292	258	182	330	318	369	423
15	Other public order and safety	0	0	0	310	262	285	380	248	286	330	421	297	378	610	539	381	690	666	773	886

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Table 7-6b Building Activity Fossil-Fuel Site Energy Use Intensity Targets ($FEUI_{t1}$) (SI) *(Continued)*

		Fossil-Fuel Site Energy Use 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
16	Medical office (diagnostic)	0	0	0	140	123	144	180	131	144	158	188	143	168	257	247	161	276	291	289	300
17	Clinic/other outpatient health	0	0	0	157	137	160	201	147	160	176	210	160	187	287	275	180	308	325	322	335
18	Refrigerated warehouse	0	0	0	220	186	202	270	176	203	234	299	211	268	434	383	271	490	473	549	629
19	Religious worship	0	0	0	73	62	67	90	59	68	78	100	70	90	145	128	90	164	158	183	210
20	Entertainment/culture	0	0	0	117	99	107	143	93	108	124	159	112	142	230	203	143	260	251	291	334
21	Library	0	0	0	183	154	168	224	146	168	194	248	175	223	360	318	225	407	393	456	523
22	Recreation	0	0	0	133	112	122	163	106	123	141	181	127	162	262	231	163	296	286	332	380
23	Social/meeting	0	0	0	122	103	112	150	98	113	130	166	117	149	241	213	150	272	263	305	349
24	Other public assembly	0	0	0	147	124	135	180	117	135	156	200	141	179	289	256	181	327	316	366	420
25	College/university	0	0	0	244	189	201	277	154	201	212	329	217	289	505	414	299	599	550	698	867
26	Elementary/middle school	0	0	0	126	101	112	148	94	110	126	167	117	148	242	213	147	277	266	318	391
27	High school	0	0	0	176	137	145	200	111	146	153	238	157	209	365	299	216	433	398	504	626
28	Preschool/daycare	0	0	0	176	141	156	206	131	154	176	233	164	207	337	297	205	386	371	443	545
29	Other classroom education	0	0	0	106	86	94	125	79	93	106	141	99	125	204	180	124	234	224	268	330
30	Fast food	0	0	0	962	853	976	1282	898	993	1197	1458	1048	1372	2175	1929	1433	2404	2356	2671	2969
31	Restaurant/cafeteria	0	0	0	683	594	675	903	614	694	829	1040	746	988	1545	1368	1042	1698	1676	1883	2084
32	Other food service	0	0	0	239	208	237	317	215	243	291	365	262	347	542	480	365	595	588	660	731
33	Hospital/inpatient health	0	0	0	613	562	572	783	567	580	760	817	577	769	1076	959	724	1124	1127	1169	1186
34	Nursing home/assisted living	0	0	0	257	200	228	339	194	246	249	441	282	398	696	565	434	816	755	948	1113
35	Dormitory/ fraternity/sorority	0	0	0	134	104	119	178	101	129	130	231	147	208	364	296	227	427	395	496	583
36	Hotel	0	0	0	154	141	150	208	153	157	192	235	168	220	346	312	230	382	378	420	458
37	Motel or inn	0	0	0	164	139	153	189	139	149	183	196	148	183	275	255	184	296	295	315	331
38	Other lodging	0	0	0	195	166	183	226	166	178	218	234	176	218	329	304	219	354	352	376	395
39	Vehicle dealership/ showroom	0	0	0	143	120	132	190	108	139	148	225	154	198	353	302	216	419	393	490	588
40	Retail store	0	0	0	118	100	109	158	90	115	123	186	127	164	292	250	179	347	326	406	487

Table 7-6b Building Activity Fossil-Fuel Site Energy Use Intensity Targets ($FEUI_{tt}$) (SI) *(Continued)*

		Fossil-Fuel Site Energy Use 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	0	0	0	166	140	153	221	126	162	173	262	179	230	410	351	251	487	457	569	683
42	Post office/postal center	0	0	0	147	114	130	194	111	141	142	252	161	227	398	323	248	466	432	542	636
43	Repair shop	0	0	0	50	44	58	105	50	72	68	155	98	121	287	229	136	393	339	502	642
44	Vehicle service/repair shop	0	0	0	65	56	74	134	64	92	86	198	125	155	367	293	174	502	434	642	820
45	Vehicle storage/ maintenance	0	0	0	48	42	55	100	48	69	64	148	93	116	274	219	130	375	324	479	613
46	Other service	0	0	0	70	60	80	145	69	99	93	214	135	167	396	317	188	542	468	693	885
47	Strip shopping mall	0	0	0	259	209	232	329	188	243	265	393	267	350	620	523	378	732	688	857	1027
48	Enclosed mall	0	0	0	156	126	140	198	113	146	159	236	160	210	373	315	227	441	414	516	618
49	Bar/pub/lounge	0	0	0	298	259	294	393	267	302	361	453	325	431	673	596	454	740	730	820	908
50	Courthouse/probation office	0	0	0	254	225	227	318	208	227	282	347	230	306	464	401	285	519	487	570	637

		Fossil-Fuel Site Energy Use 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	0	0	0	123	96	109	163	93	118	119	211	135	191	334	271	230	391	362	455	534
52	Single-family detached	0	0	0	105	81	93	138	79	100	101	180	115	162	283	230	169	332	308	386	453
53	Single-family attached	0	0	0	98	76	86	129	74	93	94	168	107	151	265	215	197	310	287	360	423
54	Apartment (in 2 to 4 unit *building*)	0	0	0	114	88	101	150	86	109	110	196	125	176	309	250	286	362	335	420	494
55	Apartment (in 5+ unit *building*)	0	0	0	91	70	80	120	68	87	88	156	99	140	246	199	197	288	267	335	393

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Table 7-7 Building Operating Shifts Normalization Factor

No.	Building Activity/Type	Weekly Hours: 50 or Less	51 to 167	168
1	Admin/professional office	1.0	1.0	1.4
2	Bank/other financial	1.0	1.0	1.4
3	Government office	1.0	1.0	1.4
4	Medical office (nondiagnostic)	1.0	1.0	1.4
5	Mixed-use office	1.0	1.0	1.4
6	Other office	1.0	1.0	1.4
7	Laboratory	1.0	1.0	1.0
8	Distribution/ship center	0.7	1.4	2.1
9	Nonrefrigerated warehouse	0.7	1.4	2.1
10	Convenience store	1.0	1.0	1.4
11	Convenience store and gas	1.0	1.0	1.4
12	Grocery/food market	1.0	1.0	1.4
13	Other food sales	1.0	1.0	1.4
14	Fire/police station	0.8	0.8	1.1
15	Other public order/safety	0.8	0.8	1.1
16	Medical office (diagnostic)	1.0	1.0	1.5
17	Clinic/other outpatient health	1.0	1.0	1.5
18	Refrigerated warehouse	1.0	1.0	1.0
19	Religious worship	0.9	1.7	1.7
20	Entertainment/culture	0.8	1.5	1.5
21	Library	0.8	1.5	1.5
22	Recreation	0.8	1.5	1.5
23	Social/meeting	0.8	1.5	1.5
24	Other public assembly	0.8	1.5	1.5
25	College/university	0.8	1.3	1.3
26	Elementary/middle school	0.8	1.3	1.3
27	High school	0.8	1.3	1.3
28	Preschool/daycare	0.8	1.3	1.3
29	Other classroom education	0.8	1.3	1.3

No.	Building Activity/Type	Weekly Hours: 50 or Less	51 to 167	168
30	Fast food	0.4	1.1	2.1
31	Restaurant/cafeteria	0.4	1.1	2.1
32	Other food service	0.4	1.1	2.1
33	Hospital/inpatient health	1.0	1.0	1.0
34	Nursing home/assisted living	1.0	1.0	1.0
35	Dormitory/fraternity/sorority	1.0	1.0	1.0
36	Hotel	1.0	1.0	1.0
37	Motel or inn	1.0	1.0	1.0
38	Other lodging	1.0	1.0	1.0
39	Vehicledealership/showroom	0.8	1.2	1.8
40	Retail store	0.8	1.2	1.8
41	Other retail	0.8	1.2	1.8
42	Post office/postal center	0.7	1.5	1.5
43	Repair shop	0.7	1.5	1.5
44	Vehicle service/repair shop	0.7	1.5	1.5
45	Vehicle storage/maintenance	0.7	1.5	1.5
46	Other service	0.7	1.5	1.5
47	Strip shopping mall	1.0	1.0	1.0
48	Enclosed mall	1.0	1.0	1.0
49	Bar/pub/lounge	1.0	1.0	1.4
50	Courthouse/probation office	1.0	1.0	1.4

No.	Residential Building Activity/Type	Weekly Hours: 50 or Less	51 to 167	168
51	Mobile home	1.0	1.0	1.0
52	Single-family detached	1.0	1.0	1.0
53	Single-family detached	1.0	1.0	1.0
54	Apartment *building* (2 to 4 units)	1.0	1.0	1.0
55	Apartment *building* (5+ units)	1.0	1.0	1.0

7.3.4 Greenhouse Gas Intensity Targets for Vacant and Partially Vacant Buildings

7.3.4.1 The *GHGI target* for a 100% vacant *building* shall be based on its prevacancy activity if the intended use of the *building* will be unchanged.

7.3.4.2 If the total floor area of a nonheated, noncooled, and nonilluminated vacant part of a *building* is less than 30% of the gross floor area, then it shall be excluded from the gross floor area, and the *GHGI target* shall be determined based on the remainder of the *building* as described in Section 7.3.3.

7.3.4.3 If the vacant part of a *building* is heated and/or cooled and the *building* energy use data for a

recent 12 consecutive month period when the *building* was occupied is not available, compliance of this part of the *building* will be determined after it becomes occupied and energy use data become available for 12 consecutive months.

8. ENERGY AUDIT WITH DECARBONIZATION ASSESSMENT REQUIREMENTS

8.1 The *qualified energy auditor* shall complete Forms D and/or E and submit them to the *authority having jurisdiction* (*AHJ*). If an energy audit with decarbonization assessment is required (see Section 4), a copy of the audit summary results shall be included in the compliance documentation. Compliance with this standard shall be achieved by adopting *energy efficiency measures* (*EEMs*) that collectively reduce annual *building* energy use and by adopting *emission reduction measures* (*ERMs*) that reduce annual *building greenhouse gas* (*GHG*) *emissions*.

8.1.1 Decarbonization Assessment. The energy audit with decarbonization assessment determines achievable levels of *GHG emissions* reductions in a *building* through energy efficiency, electrification, fugitive *GHG emissions* reduction, and onsite renewable energy. Beyond identification of *EEMs* as in a typical energy audit, the decarbonization assessment considers additional *ERMs*, including electrification measures (even partial electrification solutions), fugitive *ERMs*, and further renewable energy measures.

8.1.2 Requirements for Measures. The *optimized bundle of ERMs* shall not increase the *energy use intensity* (*EUI*) or *greenhouse gas intensity* (*GHGI*) of the *building*.

8.2 Energy Audit with Decarbonization Assessment Requirements for Buildings without Performance Targets

8.2.1 Overall Process. An energy audit with decarbonization assessment shall be conducted for all *buildings* not having a *performance target*. The energy audit with decarbonization assessment and the associated report shall be completed by a *qualified energy auditor* practicing within their field of competency. The energy audit with decarbonization assessment shall be a Level 2 audit (as described in Section 8.4). For a *building* having a gross floor area 10,000 ft^2 (1000 m^2) or less, either a Level 1 audit or a Level 2 audit (as described in Section 8.4) shall be conducted.

Exception to 8.2.1: *Buildings* that have completed an energy audit with decarbonization assessment within the previous three years may use the results of the previous audit, provided that the scope of the energy audit with decarbonization assessment meets the requirements of this section and that there have been minimal changes to the systems within the audit scope.

8.2.2 Following the completion of the energy audit with decarbonization assessment, the *building owner* will select and implement *EEMs* and *ERMs* per the requirements of Section 9.

8.3 Energy Audit with Decarbonization Assessment Requirements for Buildings with Performance Targets

8.3.1 Buildings that Meet Their Performance Targets. *Buildings* that meet their *performance targets* under Section 7 are not required to perform an energy audit with decarbonization assessment.

8.3.2 Buildings that Do not Meet Their Energy Use Intensity Targets Overall Process. An energy audit with decarbonization assessment shall be conducted, and an associated report shall be provided, for all *buildings* that do not meet their *performance target*. The energy audit with decarbonization assessment shall be completed by a *qualified energy auditor* practicing within their field of competency. The energy audit with decarbonization assessment shall be at an audit level specified by the *qualified energy auditor* to be sufficient to identify and evaluate the *EEMs* and *ERMs* that, if implemented, would result in the *building* meeting its *performance target*. The *qualified energy auditor* may refer to the list of potential *EEMs* in Informative Appendix H.

After the completion of the energy audit with decarbonization assessment and the selection of *EEMs* and *ERMs* to be implemented, the applicant must calculate an adjusted *EUI* according to Section 8.3.2.1 and an adjusted *GHGI* according to Section 8.3.2.2 for the *building* based on the estimated energy savings and *GHG* emissions reductions from the selected *EEMs* and *ERMs* and the historical energy use and *GHG emissions* of the *building*. The adjusted *EUI* is compared to the *EUI target* for the *building*, and the adjusted *GHGI* is compared to the *GHGI target* for the *building*. If the adjusted *EUI* is less than the *EUI target*, and if the adjusted *GHGI* is less than the *GHGI target*, the applicant shall proceed with implementation (see Section 9). If either the adjusted *EUI* is greater than the *EUI target* or the adjusted *GHGI* is greater than the *GHGI target*, a more rigorous energy audit with decarbonization assessment investigation is required to identify additional *EEMs* and *ERMs*. This process is repeated until the *building*'s adjusted *EUI* is less than its *EUI target* and the *building*'s adjusted *GHGI* is less than its *GHGI target*.

Exception to 8.3.2: *Buildings* that have completed an energy audit with decarbonization assessment within

the previous three years may use the previous energy audit with decarbonization assessment to identify *EEMs* and *ERMs* for implementation, provided that the scope of the energy audit with decarbonization assessment meets the requirements of this section and there have been minimal changes to the systems within the audit scope. In this case, the same comparison of adjusted *EUI* to *EUI target* and *GHGI* to

GHGI target shall be made by the applicant. If the *EEMs* and *ERMs* identified in the audit are still applicable, have not been implemented, and if implemented would result in the *building* meeting its *EUI target* and *GHGI target*, these measures shall be implemented by the *building*, and the project shall follow the procedures in Section 9. If the identified *EEMs* and *ERMs* do not result in an adjusted *EUI* less than the *EUI target* and a *GHGI* less than the *GHGI target*, a new energy audit with decarbonization assessment shall be conducted as described Section 8.3.2.

8.3.2.1 Adjusted *EUI* shall be calculated using Equation 8-1:

$$EUI_{adj} = (\text{Energy}_{hist} - \text{Energy}_{saved})/\text{GFA} \quad (8\text{-}1)$$

where

Energy_{hist} = historical annual *gross energy* use, kBtu (MJ)
Energy_{saved} = estimated annual *gross energy* savings, kBtu (MJ)
GFA = gross floor area, ft^2 (m^2)

8.3.2.2 Adjusted *GHGI* shall be calculated using Equation 8-2:

$$GHGI_{adj} = (\text{GHG}_{hist} - \text{GHG}_{saved})/\text{GFA} \quad (8\text{-}2)$$

where

GHG_{hist} = historical annual *GHG emissions*, kBtu (MJ)
GHG_{saved} = estimated annual GHG savings, kBtu (MJ)
GFA = gross floor area, ft^2 (m^2)

8.4 Energy Audit with Decarbonization Assessment. This section outlines the requirements for Level 1 and Level 2 energy audits for *buildings*. If required, the energy audit with decarbonization assessment shall be performed. A Level 1 and Level 2 energy audit with decarbonization assessment is a Level 1 and Level 2 *building* decarbonization assessment per all normative requirements in ANSI/ASHRAE/ACCA 211 [5], including Informative Appendix H, "Building Decarbonization Assessment." *Building GHG emissions* and *GHG emissions* reductions shall be calculated using the methodology defined in Section 5.2.3.3 of this standard.

9. IMPLEMENTATION AND VERIFICATION REQUIREMENTS

9.1 Developing and Implementing an Energy and Emissions Management Plan

9.1.1 Requirements. *Buildings* that have *performance targets* shall comply with the requirements of Section 9.1.1.1. *Buildings* that do not have *performance targets* shall comply with the requirements of Section 9.1.1.2. All *buildings* larger than 5000 ft^2 (465 m^2) shall implement an energy and emissions management plan as described in Section 5. The energy and emissions management plan shall be integrated into the *building*'s *capital management plan* as described in Section 5. The energy and emissions management plan shall include the elements listed in Section 5.

9.1.1.1 Buildings with Performance Targets. For *buildings* having *performance targets*, *energy efficiency measures* (*EEMs*), and *emissions reduction measure* (*ERMs*) identified from the energy audit with decarbonization assessment shall be implemented in order to meet the *building*'s *energy use intensity* (*EUI*) *target* and *greenhouse gas intensity* (*GHGI*) *target*. Develop a written plan for maintaining the *building*'s *EUI* and *GHGI* at or below the *EUI target* and *GHGI target*. Implementation of the *EEMs* and *ERMs* and the plan for maintaining the *building* operations below the targets shall not result in an increase in either the *building*'s *EUI* or *GHGI*.

9.1.1.2 Buildings without Performance Targets. *Buildings* that do not have *performance targets* shall implement the *EEMs* and *ERMs* identified from the energy audit with decarbonization assessment within four years from the application of compliance. Implementation of the *EEMs* and *ERMs* shall not result in an increase in either the *building*'s *EUI* or *GHGI.*

9.1.1.2.1 For nonfederal *buildings*, the *qualified energy auditor* shall first determine the *optimized bundle of EEMs* and then determine the *optimized bundle of ERMs*.

9.1.1.2.2 The *optimized bundle* of *EEMs* shall use all *EEMs* with a combined *simple payback* less than or equal to five years.

Exceptions to 9.1.1.2.2:

1. A life-cycle approach may be used with the *optimized bundle of EEMs* with an *internal rate of return*

(*IRR*) greater than or equal to 20% using the Federal Energy Management Program's BLCC5 [6] software with the current BLCC5 defaults.

2. *EEMs* that have *simple payback* greater than the effective useful life of the equipment shall be excluded from the *optimized bundle of EEMs*.

3. *EEMs* that are no longer appropriate due to deeper retrofits specified for the same equipment in the *optimized bundle of ERMs* described in Section 9.1.1.2.2 can be excluded from the *optimized bundle of EEMs*.

Informative Note: For example, an *EEM* for a variable-speed-fan retrofit on a rooftop unit would no longer be appropriate if the *optimized bundle of ERMs* included an *ERM* to replace the entire rooftop unit with a heat-pump rooftop unit with a variable-speed fan. In this case, the variable-speed-fan retrofit *EEM* should not be included in the *optimized bundle of EEMs*.

9.1.1.2.3 The *optimized bundle of ERMs* shall use all *EEMs* identified in Section 9.1.1.2.2 and *ERMs* with a combined *simple payback* less than or equal to ten years. For the purposes of this combined *simple payback* calculation, *EEM* energy savings shall be translated into *GHG emissions* reductions and shall include *carbon cost* to account for the impact of the measures where the *energy cost* does not already include *carbon costs*.

Exceptions to 9.1.1.2.3:

1. A life-cycle approach may be used with the *optimized bundle of ERMs* with an *internal rate of return* (*IRR*) greater than or equal to 15% using BLCC5 with the current BLCC5 defaults. BLCC5 is a freemarket tool and can be found online.
2. *ERMs* that have *simple payback* greater than the effective useful life of the equipment shall be excluded from the *optimized bundle of ERMs*.
3. *ERMs* that require the replacement of equipment that has an estimated useful life of greater than five years shall not be required to be implemented. Where the *ERM* is not implemented, a specific plan for replacement of equipment at the end of its useful life shall be filed with the *authority having jurisdiction* (*AHJ*) and included in the *capital management plan*, and the measure shall be excluded from verification under Section 9.2. On end of life of the equipment, the *ERM* must be implemented.

9.1.1.2.4 Federal *buildings* shall follow the National Institute of Standards and Technology (NIST) Building Life-Cycle Cost (BLCC) Program, and the *optimized bundle* of *EEMs* shall use all *EEMs* with a savings to investment ratio (SIR) to meet federal requirements.

9.1.1.2.5 Identified *EEMs* and *ERMs* that are not selected for implementation and have *simple payback* less than the effective useful life of the equipment shall be listed as future opportunities and included in the *building*'s *capital management plan*, including discussion of timeframe and triggers for measure implementation.

9.1.2 Implementing the Energy and Emissions Management Plan. The sequence in which measures are implemented shall be evaluated so that *EEMs* and *ERMs* take into account the impact of previously implemented *EEMs* and *ERMs* and do not result in an increase in either the *building*'s *EUI* or *GHGI*.

9.1.2.1 Training of Building Staff. An ongoing written training plan shall be implemented. *Building* occupants and staff shall be trained, at a minimum, as established by the operations and maintenance (O&M) program defined in Section 6.

Exception to 9.1.2.1: *Buildings* 5000 ft^2 (465 m^2) and less.

9.1.2.2 Multiple Buildings. For campuses having multiple *buildings* connected through one billing meter, a multiple-*building* plan shall be implemented to coordinate *EEM* and *ERM* implementation among the *buildings* and measurement of the *EUI* and *GHGI* of the campus.

9.1.2.3 Implementation and Commissioning of Energy Efficiency Measures and Emissions Reduction Measures. *EEMs* and *ERMs* shall be implemented and commissioned. The *qualified energy auditor* or *qualified person* shall review the commissioning report and certify that the *EEMs* and *ERMs* are functioning as intended.

Informative Note: For guidance on commissioning protocols, refer to ASHRAE Guideline 0 and ASHRAE Guideline 1.1.

9.1.2.4 Energy Efficiency and Emissions Reduction Priorities. Implementation of *EEMs* and *ERMs* shall be prioritized to take advantage of the life cycle of *building* systems and to minimize the disruption to *building* occupants.

9.2 Verification of Implemented Energy Efficiency Measures and Emissions Reduction Measures

Note: These draft rules for the June 5, 2024 public meeting cover Chapters 1-6 only. Comments may be made at:
Comment on Chapters 1-3: https://odoe.powerappsportals.us/en-US/bps2/
Comment on Chapters 4-6: https://odoe.powerappsportals.us/en-US/bps-5-22-2024/

9.2.1 Verification of Energy Efficiency Measures and Emissions Reduction Measures for Buildings with Performance Targets. Upon implementation of *EEMs* and *ERMs*, the *building*'s *EUI* and *GHGI* shall be monitored until one full year's data demonstrate that *performance targets* have been met and the implementation did not result in an increase in either the *building*'s *EUI* or *GHGI*.

9.2.2 Verification of Implemented Energy Efficiency Measures and Emissions Reduction Measures for Buildings without Performance Targets. Upon implementation of *EEMs* and *ERMs*, the affected enduse systems shall be monitored for one year to verify *EEM* and *ERM* energy savings and *GHG emissions* reduction. The *qualified energy auditor* or *qualified person* shall review the results of the *EEM* and *ERM* energy monitoring and certify that the energy savings and *GHG emissions* reduction projected in the energy audit with decarbonization assessment and the implementation did not result in an increase in either the *building*'s *EUI* or *GHGI.*

9.3 Compliance. The *qualified person* shall complete the compliance documentation as required in Section 4.

10. RESIDENTIAL BUILDINGS AND DWELLING UNITS

10.1 Compliance Requirements

10.1.1 Compliance Process. Residential *buildings* and dwelling units shall comply with the requirements of Section 10.4. Figure 10-1 illustrates the compliance process for residential *buildings* and dwelling units.

10.1.2 This section applies to individual dwelling and housing units that are covered under the Residential Energy Consumption Survey (RECS) [4] administered by the EIA and identified by activities numbered 51 through 55 in Table 7-1.

10.1.3 This section includes the following.

10.1.3.1 Attached/detached single-family houses.

10.1.3.2 Manufactured and modular housing units and mobile homes.

10.1.3.3 Individual dwelling units, such as apartments or condominiums, within multifamily housing *buildings* (when addressed separately from common areas), provided that all energy used in a dwelling unit is metered separately for that dwelling unit.

10.1.4 All other *residential buildings*, including multifamily housing-unit common areas as well as those units without separate dwelling-unit metering, are covered by the commercial sections of this standard in Sections 4 and 7 as *building* type 53. Barracks and dormitories are covered in Sections 4 and 7 as *building* type 35.

10.1.5 A multifamily *residential building* or an individual dwelling unit can be granted *conditional compliance* for up to 15 months following completion of Sections 10.2, 10.3, 10.4, 10.5, and 10.6. Within 15 months, the *building* or dwelling unit is reevaluated for its *energy use intensity* (*EUI*), and the *conditional compliance* either becomes full compliance or is revoked and the *building* does not comply with the standard.

10.1.6 The timeline for compliance is shown in Informative Appendix D.

10.1.7 Compliance forms for reporting compliance to the *authority having jurisdiction* (*AHJ*) are found in Normative Appendix A.

10.2 Energy Use Intensity

10.2.1 Compliance with this section requires the reporting of annual *EUI* for a *building* or individual dwelling unit. The *building* or dwelling-unit owner shall report the *EUI* and *EUI target* on Form A.

10.2.2 Collect *building* energy use data, and report this information using Form B. Annual *gross energy* use is *building* energy use data for 12 consecutive months within the last 18 months. Refer to Section 5.2 for details of the collection and recording of *building* energy use data.

Residential buildings' *EUI* shall be calculated as follows:

EUI = annual *gross energy* use, Btu/*gross floor area for residential buildings*, ft^2 (I-P)

EUI = annual *gross energy* use, MJ/*gross floor area for residential buildings*, m^2 (SI)

10.3 Operations and Maintenance (O&M)

10.3.1 Operations and Maintenance Program. The *building* systems shall be operated and maintained in order to ensure that the *building* or dwelling unit and its energy-using systems achieve their intended energy efficiency throughout their service life.

10.3.1.1 When applied to this standard, Sections 4, 5, and 6 of ANSI/ACCA Standard 4 [7] shall apply to all *building* systems. References to Section 7 and Appendix A of ACCA Standard 4 shall not apply.

10.3.1.2 All O&M activities shall conform to the manufacturers' requirements.

10.3.2 The O&M requirements shall be reevaluated when *building* use changes or other changes are made that affect the *building*'s operations.

Note: These draft rules for the June 5, 2024 public meeting cover Chapters 1-6 only. Comments may be made at:
Comment on Chapters 1-3: https://odoe.powerappsportals.us/en-US/bps2/
Comment on Chapters 4-6: https://odoe.powerappsportals.us/en-US/bps-5-22-2024/

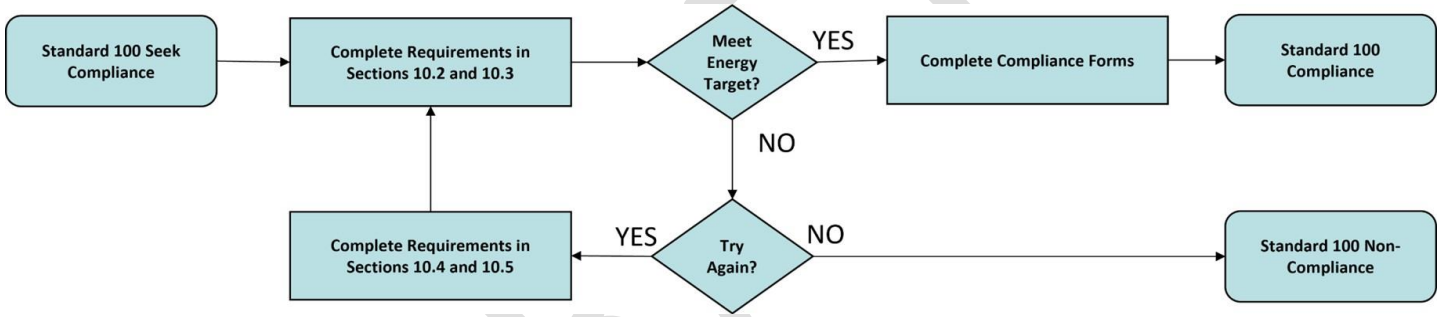

Figure 10-1 Flowchart for residential buildings.

10.3.3 Equipment and Component Replacement

10.3.3.1 When HVAC, domestic hot-water heating, and refrigeration equipment and appliances are replaced, the replacement equipment shall meet the most stringent energy efficiency requirements in the federal equipment standards, the applicable *building* code, or ASHRAE Standard 90.2 [8].

Exception to 10.3.3.1: For multiunit *residential buildings* that are higher than three stories, replacement equipment shall meet the applicable *building* code or ASHRAE/IES Standard 90.1 [9] requirements.

10.3.3.2 Lighting Replacement

10.3.3.2.1 When lighting equipment is replaced, the replacement equipment shall meet the most stringent energy efficiency requirements in both the federal equipment standards and in the applicable *building* code.

10.3.3.2.2 The replacement of any lighting equipment shall not increase the existing installed lighting power unless the current light levels do not meet IES recommendations [10].

10.3.4 Report Building Characteristics. The following basic characteristics shall be reported on Form B.

10.3.4.1 A *building* identifier (optional) and *building* address, including city, state, country, and mail and postal code.

10.3.4.2 The ASHRAE climate zone as found on the map in Informative Appendix E.

10.3.4.3 The start and end dates of the 12 month data measurement period.

10.3.4.4 The gross floor area of the *building* in square feet (square metres) as defined in Section 3.

10.3.4.5 The number of conditioned floors, with subtotals of above-grade and below-grade floors.

10.3.4.6 *Building* type, which relates to the occupancy carried out in the *building*.

10.3.4.7 Select *building* types from among the types of *residential buildings* listed in Table 7-1.

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.

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*.

10.3.7 If the *building EUI* meets the *EUI target*, complete the compliance forms for *buildings* with *EUI targets* (Section 4).

10.3.8 If the *building EUI* exceeds the *EUI target*, the operational settings shall be reviewed and the *building* shall undergo an energy audit as described in Section 10.4. The *building* will then need to be retrofitted and *energy efficiency measures* (*EEMs*) implemented to improve energy *performance* in order to be in compliance with this standard.

10.4 Energy Audit Requirements

10.4.1 Buildings that Meet Energy Use Intensity Targets. *Residential buildings* and *dwelling units* that meet their *EUI targets* under Section 10 comply with Standard 100. Compliance shall be reported according to Section 10.1.7.

10.4.2 Buildings that Do Not Meet Their Energy Use Intensity Targets. A Level 1 or Level 2 energy audit shall be conducted for all *buildings* that do not meet their *EUI target*. The energy audit shall be completed by the *building owner* or *qualified person* and be at an audit level sufficient to identify and evaluate the *EEMs* that, if implemented, would result in the *building* meeting its *EUI target*. The *building owner* or *qualified person* may refer to the list of *EEMs* in Informative Appendix H.

Exception to 10.4.2: *Buildings* that have completed an energy audit within the previous three years may

use the previous energy audit to identify *EEMs* for implementation. After the completion of the audit and the selection of *EEMs* to be implemented, the applicant must calculate an adjusted *EUI* for the *building* based on the estimated energy savings from the selected *EEMs* and the historical energy use of the *building*. This adjusted *EUI* is then compared to the *EUI target* for the *building*. If the adjusted *EUI* is less than the *EUI target*, the applicant shall proceed with implementation (see Section 10.5).

10.4.3 If the adjusted *EUI* is greater than the *EUI target*, a more rigorous energy audit is required to identify additional *EEMs*. This process is repeated until the adjusted *EUI* is less than the *EUI target*.

10.4.4 Calculation of the adjusted *EUI* is shown in Equation 10-1:

$$EUI_{adj} = (Energy_{hist} - Energy_{saved})/GFA \quad (10\text{-}1)$$

where

$Energy_{hist}$ = historical annual energy use, kBtu (MJ)

$Energy_{saved}$ = annual energy savings, kBtu (MJ)

GFA = *gross floor area for residential buildings*, ft^2 (m^2)

Following the completion of an energy audit that has identified *EEMs* sufficient to meet the *building*'s *EUI target*, the applicant shall implement those *EEMs* per the requirements of Section 10.5.

10.4.5 Energy Audit Levels. This section outlines the requirements for Level 1 and Level 2 energy audits.

10.4.5.1 Level 1 Audit. *Residential buildings* shall complete either of the following.

10.4.5.1.1 An online home energy audit using the Department of Energy's Home Energy Saver Pro website.

10.4.5.1.2 An in-home energy survey audit per the Residential Energy Services Network (RESNET) National Standard for Home Energy Audits.

10.4.5.2 Level 2 Audit. *Residential buildings* shall perform a home energy audit comparable to the level of effort defined by either of the following.

10.4.5.2.1 Comprehensive home energy audit according to the RESNET National Standard for Home Energy Audits.

10.4.5.2.2 The Building Performance Institute's *Home Energy Auditing Standard* [11].

10.4.6 Building Audit Report. This section prescribes the overall approaches and methods to be used in the energy audit report for audits completed under Section 10.4.5.1 or 10.4.5.2.

10.4.6.1 Audit Results

10.4.6.1.1 The energy audit report shall define the actions necessary for the *building owner* to achieve the energy and cost savings that are recommended.

10.4.6.1.2 Energy audit results shall be presented in a summary table that includes, at a minimum, an estimate of each of the following:

a. A list of recommended operational setting adjustments and *EEMs* that, if implemented, shall meet the *EUI target* for the *building*.
b. The energy savings associated with each recommended *EEM* expressed in the cost units used on the *building owner*'s energy bills, and the units used for comparison with the *EUI target*.

10.4.6.1.3 The estimated (or modeled) utility cost savings associated with each recommended *EEM*.

10.4.6.1.4 The estimated cost of implementation for each recommended *EEM*. The costs of implementation shall include the required monitoring of energy savings per the requirements of Section 10.6.

10.4.6.1.5 The *simple payback* for each recommended *EEM* or bundle of *EEMs*.

10.4.6.2 Measure Order. When considering multiple *EEMs* with *interactive effects*, the order of analysis shall start with load reduction measures and proceed through distribution systems and then plant and heat rejection systems.

10.4.6.3 Financial Analysis. Financial analysis shall be made using current utility rate charges for the site. For customers who are charged based on time-of-use or peak demand (kW), cost analysis of those *EEMs* shall include appropriate treatment of the costs savings associated with the measures and reflect peak demand or time-of-use cost savings, if applicable.

10.4.6.3.1 The minimum financial criteria required for reporting include the following:

a. *EEM* implementation cost
b. *Energy cost* savings based on current utility rates
c. O&M cost savings (or penalties)

d. *EEM simple payback*
e. *EEM* measure life

10.4.7 End-Use Analysis. The energy audit shall include an end-use analysis that compares the estimated energy use of the *building* or individual dwelling unit after implementation of all selected *EEMs* to

historical utility consumption. The intent of this requirement is to ensure that estimates of the base-case end-use energy estimates and potential energy-savings estimates in the energy audit report are reasonable.

10.4.7.1 Level 1 Requirements. The analysis shall demonstrate that the sum of base-case end-use energy estimates total no more than the historical energy consumption for the end use at the site. This shall be done by completing the following.

10.4.7.1.1 The historic energy use shall be apportioned into each of the end uses, such as HVAC, lighting, domestic hot water, and plug loads.

The *building owner* or *qualified person* shall verify that each *EEM* savings estimate is reasonable as compared to the energy consumption of that end use based on energy consumption survey data or experience with similar sites.

10.4.7.1.2 End-use analysis shall be conducted for all fuel types at the site, such as electricity, natural gas, or fuel oil, for which *EEMs* are identified.

Informative Note: For example, if the audit identifies lighting retrofit opportunities, the *building owner* or *qualified person* shall compare the identified energy savings for those opportunities with the base-case energy use of the facility and demonstrate that they make up a reasonable fraction of the historical electricity consumption at the site.

10.4.7.2 Level 2 Requirements. If a Level 2 audit is necessary, the *building owner* or *qualified person* shall estimate the energy use of all end uses that individually comprise more than 5% of total historical *building* energy use. The energy estimates for these end uses shall be summed and compared to historical energy consumption for the facility. The sum of the base-case end-use energy estimates must be between 90% and 100% of the historical energy use at the site.

10.4.7.3 This comparison shall be conducted separately for each fuel type, such as electricity, natural gas, or fuel oil, for which *EEMs* are identified. On-site energy sources such as solar, photovoltaic, geothermal, and wind, shall be included.

10.4.7.4 The same energy use estimates that comprise the end-use analysis shall also be used as the basis for energy-savings calculations. The *building owner* or *qualified person* shall verify that each *EEM* savings estimate is reasonable as compared to the historical energy consumption of that end use based on energy consumption survey data or experience with similar sites.

10.4.7.5 The *building owner* or *qualified person* shall verify that the combined savings from multiple *EEMs* shall take into account *interactive effects* among measures.

10.4.7.6 Miscellaneous plug loads may be estimated on average equipment power density and *building* area.

10.4.7.7 Baseline. The *baseline* for energy- and cost-savings estimates shall be taken to be the condition of the existing *building* at the time of the initial comparison with the *building*'s *EUI target* or at the time of the initial required audit. The energy-savings estimates shall be calculated as the difference between the energy use of proposed systems and the *baseline* energy use estimates of those systems.

10.5 Implementation and Verification Requirements

10.5.1 Implementation

10.5.1.1 Requirements. *Buildings* shall comply with the requirements of Sections 10.5.1.2 and 10.5.1.3 and shall include, at a minimum, the following.

10.5.1.1.1 An O&M program as defined in Section 10.3.

10.5.1.1.2 Implementation plan for *EEMs*.

10.5.1.2 *EEMs* identified from the energy audit shall be implemented in order to meet the *building*'s *EUI target*. Develop a written plan for maintaining the *building*'s *EUI* at or below the *EUI target*.

10.5.1.3 Monitoring of *EUI*, including all implemented *EEMs*.

10.6 Monitoring. Upon implementation of *EEMs*, the *building*'s *EUI* shall be monitored until 12 consecutive months of energy use data demonstrate that the *EUI target* has been met and Form A is submitted to the *AHJ*.

10.6.1 If the *building*'s postimplementation measured *EUI* is less than or equal to the *EUI target*, the *building* complies with the standard.

Note: These draft rules for the June 5, 2024 public meeting cover Chapters 1-6 only. Comments may be made at:
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10.6.2 If the *building*'s postimplementation measured *EUI* is greater than the *EUI target*, the *building* does not comply with the standard and the *conditional compliance* is suspended until either

a. Additional *EEMs* are implemented that reduce the subsequently measured *EUI* to below the *EUI target* or
b. The *AHJ* revokes *conditional compliance*

11. REFERENCES

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10. IES. 2020. *Lighting Applications Standards: Lighting Design Criteria and Illumination Recommendations*. IES OL-IM-03. New York: Illuminating Engineering Society.
11. BPI. 2012. ANSI/BPI-1100-T-2012, *Home Energy Auditing Standard*. Saratoga Springs, NY: Building Performance Institute.

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

NORMATIVE APPENDIX A FORMS

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 tenents
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.	
$KBtu/ft^2 \cdot yr$ ($MJ/m^2 \cdot yr$)	
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 C-2).	
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).	

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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	

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Comment on Chapters 4-6: https://odoe.powerappsportals.us/en-US/bps-5-22-2024/

Complete Form B with the Following Information

1. A *building* identifier (optional) and a *building* address, including city, state, country, and zip code.
2. The ASHRAE climate zone as found on the map in Informative Appendix E.
3. The gross floor area in square feet (square metres) shall be reported as defined in Section 3.
4. If the entire *building* is a single activity/type not listed in Table 7-1, it should be listed as "*building* without target" on Form A. List "*EUI target*" as "N/A" on Form B, and Form B is considered complete.
5. Fill in fraction of gross floor area $(A)_i$ for each activity. For single-activity *buildings*, this is 1.0.
6. Fill in the operating shifts normalization factor, S_i, from Section 7-7 for each activity that has an area entered from Step 6.
7. Fill in the activity *EUI target* $(EUI_{t1})_i$ from Tables 7-2, 7-3, 7-5, and 7-6 (or table from the *authority having jurisdiction*) for each activity that has an area entered from Step 6.
8. Calculate weighted space *EUI target* $(A \times S \times EUI_{t1})_i$ for each activity that has an area entered from Step 6.
9. Add up fraction of floor area and enter sum in "Total fraction of floor area with target," and add up all weighted space *EUI target*s and enter sum as the "*EUI target*" on Forms A and B.
10. If more than 50% of gross floor area has no target, it should be listed as "building without target" on Form A. List "*EUI target*" as "N/A" on Form B.

Form B—Building Activity and Energy Use Intensity (EUI) Target

Building identifier:									
Address:									
City, State, Country, Zip (mail) Code:									
ASHRAE climate zone as found on the map in Appendix F:									
The gross floor area of the building in ft² (m²):									
Building Activity/Type	**Fraction Floor Area $(A)_i$**	**Operating Shifts $(S)_i$**	**Activity EUI Target $(EUI_{t1})_i$**	**Space $(EUI_t)_i$**	**Building Activity/Type**	**Fraction Floor Area $(A)_i$**	**Operating Shifts $(S)_i$**	**Activity EUI Target $(EUI_{t1})_i$**	**Space $(EUI_t)_i$**
Admin/professional office					Preschool/daycare				
Bank/other financial					Other classroom education				
Government office					Fast food				
Medical office (nondiagnostic)					Restaurant/cafeteria				
Mixed-use office					Other food service				
Other office					Hospital/inpatient health				
Laboratory					Nursing home/assisted living				
Distribution/ship center					Dormitory/fraternity/sorority				
Nonrefrigerated warehouse					Hotel				
Convenience store					Motel or inn				
Convenience store and gas					Other lodging				
Grocery/food market					Vehicle dealership/showroom				
Other food sales					Retail store				
Fire/police station					Other retail				

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Other public order/safety					Post office/postal center				
Medical office (diagnostic)					Repair shop				

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Comment on Chapters 4-6: https://odoe.powerappsportals.us/en-US/bps-5-22-2024/

Form B—Building Activity and Energy Use Intensity (EUI) Target *(Continued)*

Building Activity/Type	Fraction Floor Area $(A)_i$	Operating Shifts $(S)_i$	Activity EUI Target $(EUI_{t1})_i$	Space $(EUI_t)_i$	Building Activity/Type	Fraction Floor Area $(A)_i$	Operating Shifts $(S)_i$	Activity EUI Target $(EUI_{t1})_i$	Space $(EUI_t)_i$
Clinic/other outpatient health					Vehicle service/repair shop				
Refrigerated warehouse					Vehicle storage/maintenance				
Religious worship					Other service				
Entertainment/culture					Strip shopping mall				
Library					Enclosed mall				
Recreation					**Residential Building Activity/Type**				
Social/meeting					Mobile home				
Other public assembly					SF-detached				
College/university					SF-attached				
Elementary/middle school					Apartment building (2 to 4 units)				
High school					Apartment building (5+ units)				
Total fraction of floor area with target:									
EUI Target (EUI_t):									

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Comment on Chapters 4-6: https://odoe.powerappsportals.us/en-US/bps-5-22-2024/

Form C-1—Site Energy Use Intensity Calculation

	Energy Form [a]	Source of Energy Data [b]	Energy Use Numerical Value	Units	Conversion Factor [c] to kBtu (MJ)	Annual Site Energy, kBtu/yr (MJ/yr)
1a.	Imported grid electricity					
1b.	Imported specific renewable electricity [d]					
2a.	Imported grid natural gas					
2b.	Imported specific renewable natural gas [d]					
3.	Imported steam					
4.	Imported hot water					
5.	Imported chilled water					
6a.	Imported grid fuel oil					
6b.	Imported specific renewable fuel oil [d]					
7a.	Imported grid propane					
7b.	Imported specific renewal propane [d]					
8.	Imported coal or other [e]					
9.	Imported biofuels					
10.	On-site *nonrenewable energy*					
11.	Imported transportation vehicle energy					
12.	Thermal—on-site production					
13.	Electricity—on-site production					
14.	Renewable—on-site production [e]					
15.	Imported energy for on-site production					
16.	Net change in energy stored on-site					
17.	Exported electricity					
18.	Exported steam					
19.	Exported hot water					
20.	Exported chilled water					
21.	Exported other [e]					
22.	Exported transportation vehicle energy					
	Annual Gross Energy [f] (Sum of 1 to 14 minus Sum of 15 to 22), kBtu (MJ)					
	Site Energy Use Intensity (*gross energy*/gross floor area [from Form B]), kBtu/ft² (MJ/ft²)					

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 Table 5-1.
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.

Note: These draft rules for the June 5, 2024 public meeting cover Chapters 1-6 only. Comments may be made at:
Comment on Chapters 1-3: https://odoe.powerappsportals.us/en-US/bps2/
Comment on Chapters 4-6: https://odoe.powerappsportals.us/en-US/bps-5-22-2024/

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 renewal propane [c]			
8.	Imported coal or other [d]			
9.	Imported biofuels			
10.	On-site *nonrenewable 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 (*gross energy*/gross floor area [from Form B]), kBtu/ft² (MJ/ft²)			

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.

Note: These draft rules for the June 5, 2024 public meeting cover Chapters 1-6 only. Comments may be made at:
Comment on Chapters 1-3: https://odoe.powerappsportals.us/en-US/bps2/
Comment on Chapters 4-6: https://odoe.powerappsportals.us/en-US/bps-5-22-2024/

Form C-3—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_2e/kBtu (kg CO_2e/MJ)	Annual Greenhouse Gas Emissions, lb CO_2e/yr (kg CO_2e/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 *nonrenewable 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			
	Greenhouse Gas Emissions[e] (Sum of 1 to 11 minus Sum of 12 to 17), lb CO_2e (kg CO_2e)			
	Greenhouse Gas Intensity (*greenhouse gas emissions*/gross floor area), lb CO_2e/ft^2 (kg CO_2e/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.

Note: These draft rules for the June 5, 2024 public meeting cover Chapters 1-6 only. Comments may be made at:
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Form D—End Use Analysis Requirements Level 1

Compliance Form—Standard 100 **Section 8, "Energy Audit with Decarbonization Requirements"** **End-Use Analysis Requirements—Level 1**		
Complete the following tables OR attach a report summarizing same (such as DOE-2 BEPS). Add additional sheets as necessary for other fuel sources.		
Electric End Uses (List base-case energy use estimates of all identified EEMs.)		
End-Use Description	**Base-Case Consumption Estimate, kWh**	**% of Total**
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
Total:		
Historical annual electricity consumption:		
Compute % of historical:		
Fuel or Other End Uses (list base-case energy use estimates of all identified EEMs)		
End-Use Description	**Base-Case Consumption Estimate, kBtu**	**% of Total**
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
Total:		
Historical annual fuel/other consumption (kBtu):		
Compute % of historical:		
We affirm that the estimated base-case energy use for the end uses at the site are less than or equal to the annual historical energy consumption.		

Note: These draft rules for the June 5, 2024 public meeting cover Chapters 1-6 only. Comments may be made at:
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Comment on Chapters 4-6: https://odoe.powerappsportals.us/en-US/bps-5-22-2024/

Signature of person determining compliance:
_____

Note: These draft rules for the June 5, 2024 public meeting cover Chapters 1-6 only. Comments may be made at:
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Form E—End Use Analysis Requirements Level 2

Compliance Form—Standard 100 **Section 8, "Energy Audit with Decarbonization Requirements"** **End Use Analysis Requirements—Level 2**		
Complete the following tables OR attach a report summarizing same (such as DOE-2 BEPFS), Add additional sheets as necessary for other fuel sources.		
Electric End Uses (List base-case energy use estimates of all end uses that comprise >5% of annual site use).		
End-Use Description	**Base-Case Consumption Estimate, kWh**	**% of Total**
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
Total		
Historical annual electricity consumption		
Compute % of historical		
Fuel or Other End Uses (List base-case energy use estimates of all end uses that comprise >5% of annual site use.)		
End-Use Description	**Base-Case Consumption Estimate, kBtu**	**% of Total**
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
Total		
Historical annual fuel/other consumption (kBtu)		
Compute % of historical		
We affirm that ❑ All end uses that comprise >5% of the annual historic energy use are included in this analysis. ❑ The total energy use of base-case energy use is between 90% and 100% of historical consumption. ❑ The same base-case energy use was used to determine estimated energy savings for the site.		
Signature of person determining compliance: _____		

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

NORMATIVE APPENDIX B
ALTERNATIVE ENERGY INTENSITY TARGETS

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

The alternative 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 *building*s 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_{t1}) calculations by *authorities having jurisdiction* in accordance with Equation A-1.

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

where

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

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

$FEUI_{t1}$ = 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.

Note: These draft rules for the June 5, 2024 public meeting cover Chapters 1-6 only. Comments may be made at:
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Table B-1a Alternative Building Activity Site 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	53	54	46	50	46	43	45	36	42	38	47	43	42	49	45	41	55	49	61	73
2	Bank/other financial	90	92	78	85	78	74	78	61	72	64	81	73	71	83	77	69	94	84	104	125
3	Government office	59	60	51	56	51	48	51	40	47	42	53	48	46	54	50	45	61	55	68	81
4	Medical office (nondiagnostic)	52	53	45	49	45	43	45	35	42	37	47	43	41	48	45	40	55	49	60	72
5	Mixed-use office	47	48	40	44	40	38	40	32	37	33	42	38	37	43	40	36	49	44	54	65
6	Other office	44	45	38	42	38	36	38	30	35	32	40	36	35	41	38	34	46	41	51	61
7	Laboratory	152	151	132	143	132	125	135	109	126	113	144	131	129	152	141	130	172	156	191	230
8	Distribution/shipping center	10	14	10	15	14	16	23	14	20	15	33	27	26	45	38	29	62	50	78	105
9	Nonrefrigerated warehouse	6	8	6	9	8	10	14	8	12	9	20	16	16	27	23	18	37	30	47	63
10	Convenience store	177	176	160	173	173	165	188	165	177	165	207	187	196	223	205	207	246	226	270	314
11	Convenience store with gas	199	198	181	195	195	186	212	186	199	186	234	211	221	252	231	233	277	255	304	354
12	Grocery store/food market	160	159	145	157	157	149	171	150	160	150	188	170	178	203	186	187	223	205	245	285
13	Other food sales	175	175	159	172	172	164	187	164	176	164	206	186	195	222	204	205	245	225	268	312
14	Fire station/police station	55	55	48	52	48	45	49	40	46	41	52	47	47	55	51	47	62	57	69	83
15	Other public order and safety	116	114	100	109	100	95	103	83	96	85	110	99	98	116	107	99	131	119	145	175
16	Medical office (diagnostic)	52	49	50	49	47	48	49	44	48	41	49	48	44	49	49	42	52	52	54	59
17	Clinic/other outpatient health	58	55	56	55	53	54	54	49	54	46	55	53	49	54	54	47	58	58	60	66
18	Refrigerated warehouse	82	81	71	77	71	68	73	59	68	61	78	71	70	82	76	70	93	84	103	124
19	Religious worship	27	27	24	26	24	23	24	20	23	20	26	24	23	27	25	23	31	28	34	41
20	Entertainment/culture	44	43	38	41	38	36	39	31	36	32	41	37	37	44	40	37	49	45	55	66
21	Library	68	67	59	64	59	56	60	49	56	50	65	59	58	68	63	58	77	70	85	103
22	Recreation	50	49	43	47	43	41	44	36	41	37	47	43	42	50	46	42	56	51	62	75
23	Social/meeting	46	45	39	43	40	38	40	33	38	34	43	39	39	46	42	39	52	47	57	69
24	Other public assembly	55	54	47	52	48	45	49	39	45	40	52	47	46	55	51	47	62	56	69	83
25	College/university	96	90	72	86	73	67	75	51	67	55	86	73	75	96	82	77	114	98	131	171
26	Elementary/middle school	47	46	39	44	39	37	40	31	37	33	43	39	38	46	42	38	52	47	60	77

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Table B-1a Alternative Building Activity Site 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
27	High school	69	65	52	62	52	49	54	37	49	40	62	52	54	69	59	56	82	71	95	123
28	Preschool/daycare	66	64	55	62	54	52	56	44	52	46	60	55	54	64	59	53	73	66	83	107
29	Other classroom education	40	39	33	37	33	31	34	27	31	28	37	33	32	39	36	32	44	40	50	65
30	Fast food	347	342	320	338	327	326	346	300	332	310	379	351	355	412	382	371	455	420	501	585
31	Restaurant/cafeteria	249	242	223	240	228	226	244	205	232	215	270	250	256	293	271	270	322	299	353	411
32	Other food service	87	85	78	84	80	79	85	72	81	75	95	88	90	103	95	95	113	105	124	144
33	Hospital/inpatient health	220	224	205	215	216	192	211	190	194	197	212	193	199	204	190	188	213	201	219	234
34	Nursing home/assisted living	95	95	73	90	77	76	92	65	82	64	115	94	103	132	112	113	155	135	178	219
35	Dormitory/ fraternity/sorority	49	50	38	47	40	40	48	34	43	34	60	49	54	69	59	59	81	70	93	115
36	Hotel	58	55	52	54	54	50	56	51	52	50	61	56	57	66	62	60	72	67	79	90
37	Motel or inn	62	61	55	57	53	51	51	46	50	47	51	49	47	52	50	48	56	53	59	65
38	Other lodging	73	72	66	69	64	61	61	55	59	57	61	59	57	62	60	57	67	63	71	78
39	Vehicle dealership/ showroom	53	53	45	50	46	44	51	36	46	38	58	51	51	67	60	56	79	70	92	116
40	Retail store	44	44	37	41	38	37	43	30	39	32	48	43	42	55	49	46	66	58	76	96
41	Other retail	61	62	52	58	54	51	60	42	54	45	68	60	60	78	69	65	92	82	107	135
42	Post office/postal center	54	54	42	52	44	44	52	37	47	37	66	54	59	75	64	64	88	77	102	125
43	Repair shop	12	17	11	18	17	19	28	17	24	18	40	33	31	54	45	35	74	60	94	126
44	Vehicle service/repair shop	15	22	15	23	21	25	36	21	31	22	52	42	40	70	58	45	95	77	120	162
45	Vehicle storage/ maintenance	11	16	11	17	16	19	27	16	23	17	38	31	30	52	43	34	71	58	90	121
46	Other service	17	23	16	24	23	27	39	23	33	24	56	45	43	75	63	49	103	83	130	174
47	Strip shopping mall	95	96	81	91	80	78	89	63	81	69	102	89	91	117	103	98	139	123	161	202
48	Enclosed mall	57	58	49	55	48	47	53	38	49	41	61	54	55	71	62	59	83	74	97	122
49	Bar/pub/lounge	108	106	97	104	99	98	106	89	101	94	118	109	112	128	118	118	140	130	154	179
50	Courthouse/probation office	97	95	84	89	86	76	86	69	76	73	90	77	79	88	79	74	98	87	107	126

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Table B-1a Alternative Building Activity Site 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	45	45	35	43	37	37	44	31	39	31	55	45	49	63	54	60	74	65	85	105
52	Single-family detached	38	39	30	37	31	31	37	26	33	26	47	38	42	54	46	44	63	55	72	89
53	Single-family attached	36	36	28	34	29	29	35	25	31	24	44	36	39	50	42	51	59	51	68	83
54	Apartment (in 2 to 4 unit *building*)	42	42	32	40	34	34	41	29	36	29	51	42	46	58	50	74	69	60	79	97
55	Apartment (in 5+ unit *building*)	33	33	26	32	27	27	32	23	29	23	40	33	36	47	39	51	55	47	63	77

Table B-1b Alternative Building Activity Site 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	600	611	518	567	519	490	517	407	479	428	539	489	472	553	515	462	627	562	693	832
2	Bank/other financial	1023	1041	883	967	885	836	881	693	817	730	919	834	805	943	879	788	1070	958	1182	1419
3	Government office	667	679	576	631	577	545	575	452	533	476	599	544	525	615	573	514	698	625	771	926
4	Medical office (nondiagnostic)	593	603	512	560	513	484	510	402	473	423	532	483	467	546	509	457	620	555	685	822
5	Mixed-use office	530	540	458	501	459	433	457	359	423	378	476	432	417	489	456	409	554	496	613	735
6	Other office	503	512	435	476	436	411	433	341	402	359	452	410	396	464	432	388	526	471	581	698
7	Laboratory	1730	1711	1498	1627	1502	1424	1533	1238	1429	1278	1638	1486	1465	1729	1596	1477	1956	1775	2167	2611
8	Distribution/shipping center	113	159	108	167	158	183	266	157	227	165	380	308	296	513	428	333	701	570	887	1191
9	Nonrefrigerated warehouse	68	96	65	101	95	110	160	94	137	99	229	185	178	309	258	201	422	343	534	717
10	Convenience store	2006	1997	1820	1968	1968	1872	2137	1878	2006	1873	2353	2129	2230	2538	2328	2346	2795	2571	3067	3569
11	Convenience store with gas	2261	2251	2052	2218	2218	2110	2409	2117	2261	2111	2653	2399	2513	2861	2624	2644	3151	2898	3457	4023
12	Grocery store/food market	1818	1811	1650	1784	1784	1697	1937	1703	1819	1698	2133	1930	2021	2300	2110	2126	2534	2331	2780	3235
13	Other food sales	1993	1985	1809	1956	1955	1860	2123	1866	1994	1861	2338	2115	2215	2522	2313	2331	2778	2555	3047	3546
14	Fire station/police station	627	621	543	590	545	517	556	449	518	463	594	539	531	627	579	536	709	644	786	947
15	Other public order and safety	1313	1300	1137	1236	1141	1082	1164	941	1085	970	1244	1128	1113	1313	1212	1122	1485	1348	1646	1983

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Table B-1b Alternative Building Activity Site 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
16	Medical office (diagnostic)	594	561	570	560	535	546	552	499	546	465	555	543	494	554	554	475	594	589	615	671
17	Clinic/other outpatient health	663	627	637	625	597	609	616	557	609	520	620	607	552	618	619	530	663	657	687	749
18	Refrigerated warehouse	933	923	808	878	810	768	827	668	771	689	883	802	790	933	861	797	1055	957	1169	1408
19	Religious worship	311	308	270	293	270	256	276	223	257	230	295	267	264	311	287	266	352	320	390	470
20	Entertainment/culture	494	489	428	465	429	407	438	354	408	365	468	425	419	494	456	422	559	507	620	747
21	Library	774	766	671	729	672	638	686	554	640	572	733	665	656	774	715	661	876	795	970	1169
22	Recreation	563	558	488	530	489	464	499	403	465	416	534	484	477	563	520	481	637	578	706	851
23	Social/meeting	518	512	449	487	450	426	459	371	428	383	490	445	439	518	478	442	586	531	649	782
24	Other public assembly	622	616	539	586	541	513	552	446	514	460	589	535	527	622	574	532	704	639	780	940
25	College/university	1091	1023	817	974	825	764	847	585	765	624	973	824	850	1087	930	880	1290	1114	1486	1940
26	Elementary/middle school	537	524	444	503	442	424	454	357	420	371	493	446	437	520	478	432	596	538	677	874
27	High school	788	739	591	703	596	552	612	422	553	451	703	595	614	785	672	636	932	804	1073	1401
28	Preschool/daycare	748	731	619	701	616	591	632	498	585	517	687	622	609	725	667	602	831	750	943	1219
29	Other classroom education	453	443	375	424	373	358	383	301	354	313	416	376	369	439	404	365	503	454	571	738
30	Fast food	3940	3885	3635	3835	3716	3707	3926	3411	3774	3525	4305	3982	4037	4679	4334	4218	5173	4769	5689	6644
31	Restaurant/cafeteria	2826	2751	2534	2723	2588	2563	2766	2331	2636	2440	3070	2835	2909	3325	3073	3068	3653	3391	4010	4663
32	Other food service	991	965	889	955	907	899	970	817	924	856	1076	994	1020	1166	1078	1076	1281	1189	1406	1635
33	Hospital/inpatient health	2499	2547	2326	2444	2451	2175	2399	2154	2205	2238	2412	2192	2265	2315	2154	2131	2419	2280	2491	2654
34	Nursing home/assisted living	1074	1077	831	1024	870	865	1040	736	934	732	1302	1070	1170	1498	1270	1278	1755	1529	2019	2491
35	Dormitory/ fraternity/sorority	562	564	435	536	455	453	544	385	489	383	682	560	613	784	665	669	919	800	1057	1304
36	Hotel	658	628	588	613	615	570	637	582	595	566	695	638	647	744	701	676	821	766	895	1024
37	Motel or inn	699	688	628	652	606	583	579	528	565	539	580	560	539	592	573	541	638	596	672	741
38	Other lodging	835	821	749	778	723	696	691	630	674	643	692	669	643	707	684	645	761	711	802	884
39	Vehicle dealership/ showroom	598	601	506	568	524	501	582	411	528	437	664	583	582	759	678	634	900	796	1043	1315
40	Retail store	496	499	419	471	434	415	483	341	437	362	550	484	483	629	562	526	746	660	864	1090

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Table B-1b Alternative Building Activity Site 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	696	700	588	661	609	582	677	479	614	508	772	679	677	883	788	738	1047	926	1213	1529
42	Post office/postal center	613	615	475	585	497	494	594	420	534	418	744	611	669	856	725	730	1003	873	1154	1423
43	Repair shop	136	192	131	201	191	220	321	189	274	199	458	371	357	618	516	402	845	687	1069	1436
44	Vehicle service/repair shop	174	245	167	258	244	282	411	242	350	254	585	474	456	791	659	514	1080	878	1367	1836
45	Vehicle storage/ maintenance	130	183	125	192	182	210	307	181	261	190	437	354	341	590	492	383	807	656	1021	1371
46	Other service	188	264	180	278	263	304	443	261	378	274	631	512	492	853	711	554	1165	948	1475	1980
47	Strip shopping mall	1079	1089	917	1034	912	883	1007	713	923	779	1159	1013	1029	1334	1175	1111	1576	1393	1825	2298
48	Enclosed mall	649	655	552	622	548	531	606	429	555	468	697	609	619	802	707	669	948	838	1098	1382
49	Bar/pub/lounge	1231	1199	1104	1187	1128	1117	1205	1016	1149	1063	1338	1235	1268	1449	1339	1337	1592	1478	1747	2032
50	Courthouse/probation office	1098	1074	954	1013	981	864	974	789	863	829	1025	873	900	999	901	840	1117	985	1214	1426

		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	515	516	399	491	417	415	499	353	448	351	624	513	561	718	609	676	842	733	968	1194
52	Single-family detached	437	438	338	417	354	352	423	299	380	298	530	436	476	610	517	496	715	622	822	1014
53	Single-family attached	408	409	316	389	331	329	395	279	355	278	495	406	445	569	482	579	667	581	767	947
54	Apartment (in 2 to 4 unit *building*)	476	477	368	454	386	383	461	326	414	324	577	474	519	664	563	841	778	678	895	1104
55	Apartment (in 5+ unit *building*)	379	380	293	361	307	305	367	260	330	258	459	377	413	529	448	579	619	539	712	879

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

		EUIs by Building Type by Climate Zone (kBtu/ft²·yr) ASHRAE Cli-																			
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)*

		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

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Table B-2a 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 *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/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

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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
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

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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

Table B-3a Alternative Building Activity Electricity Site Energy Use Intensity Targets (I-P)

		Electricity Site Energy Use 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	53	54	46	35	33	29	27	24	29	22	28	29	24	21	21	24	24	20	26	34
2	Bank/other financial	90	92	78	59	56	50	47	42	49	38	48	50	42	36	36	41	41	34	45	57
3	Government office	59	60	51	39	37	33	31	27	32	25	31	33	27	24	23	27	27	22	29	37
4	Medical office (nondiagnostic)	52	53	45	34	33	29	27	24	28	22	28	29	24	21	21	24	24	20	26	33
5	Mixed-use office	47	48	40	31	29	26	24	22	25	20	25	26	22	19	18	21	21	17	23	30
6	Other office	44	45	38	29	28	25	23	20	24	19	23	25	21	18	17	20	20	17	22	28
7	Laboratory	152	151	132	100	95	85	81	74	86	66	85	89	76	66	65	76	75	63	82	105
8	Distribution/shipping center	10	14	10	10	10	11	14	9	14	9	20	18	15	20	17	17	27	20	34	48
9	Nonrefrigerated warehouse	6	8	6	6	6	7	9	6	8	5	12	11	9	12	10	10	16	12	20	29
10	Convenience store	177	176	160	121	125	112	114	113	120	97	122	128	115	97	94	121	107	91	116	144
11	Convenience store with gas	199	198	181	136	141	126	128	127	135	109	138	144	130	110	106	137	121	102	131	162
12	Grocery store/food market	160	159	145	109	113	102	103	102	109	88	111	116	105	88	85	110	97	82	105	130
13	Other food sales	175	175	159	120	124	111	113	112	119	96	121	127	115	97	94	121	107	90	115	143
14	Fire station/police station	55	55	48	36	35	31	30	27	31	24	31	32	27	24	23	28	27	23	30	38
15	Other public order and safety	116	114	100	76	72	65	62	56	65	50	64	68	58	50	49	58	57	47	62	80
16	Medical office (diagnostic)	52	49	50	34	34	33	29	30	33	24	29	33	26	21	22	25	23	21	23	27
17	Clinic/other outpatient health	58	55	56	38	38	36	33	33	37	27	32	36	29	24	25	27	25	23	26	30
18	Refrigerated warehouse	82	81	71	54	51	46	44	40	46	36	46	48	41	36	35	41	40	34	44	57
19	Religious worship	27	27	24	18	17	15	15	13	15	12	15	16	14	12	12	14	14	11	15	19
20	Entertainment/culture	44	43	38	28	27	24	23	21	24	19	24	25	22	19	18	22	21	18	23	30
21	Library	68	67	59	45	43	38	36	33	38	30	38	40	34	30	29	34	34	28	37	47
22	Recreation	50	49	43	32	31	28	27	24	28	22	28	29	25	22	21	25	24	20	27	34
23	Social/meeting	46	45	39	30	29	26	24	22	26	20	25	27	23	20	19	23	22	19	25	31
24	Other public assembly	55	54	47	36	34	31	29	27	31	24	31	32	27	24	23	28	27	22	30	38
25	College/university	96	90	72	60	52	46	45	35	46	32	50	49	44	42	38	46	49	39	56	78

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Table B-3a Alternative Building Activity Electricity Site Energy Use Intensity Targets (I-P) *(Continued)*

		Electricity Site Energy Use 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	47	46	39	31	28	25	24	21	25	19	26	27	23	20	19	22	23	19	26	35
27	High school	69	65	52	43	38	33	33	25	33	23	36	36	32	30	27	33	36	28	41	56
28	Preschool/daycare	66	64	55	43	39	35	34	30	35	27	36	37	32	28	27	31	32	26	36	49
29	Other classroom education	40	39	33	26	24	21	20	18	21	16	22	23	19	17	16	19	19	16	22	30
30	Fast food	347	342	320	235	236	222	209	204	226	182	223	239	209	179	175	218	198	168	215	268
31	Restaurant/cafeteria	249	242	223	167	164	154	147	140	158	126	159	170	150	128	124	159	140	119	152	188
32	Other food service	87	85	78	58	58	54	52	49	55	44	56	60	53	45	44	56	49	42	53	66
33	Hospital/inpatient health	220	224	205	150	156	130	127	129	132	116	125	131	117	89	87	110	93	80	94	107
34	Nursing home/assisted living	95	95	73	63	55	52	55	44	56	38	68	64	61	57	51	66	67	54	76	100
35	Dormitory/ fraternity/sorority	49	50	38	33	29	27	29	23	29	20	35	34	32	30	27	35	35	28	40	53
36	Hotel	58	55	52	38	39	34	34	35	36	29	36	38	33	29	28	35	32	27	34	41
37	Motel or inn	62	61	55	40	38	35	31	32	34	28	30	34	28	23	23	28	24	21	25	30
38	Other lodging	73	72	66	48	46	42	37	38	40	33	36	40	33	27	28	33	29	25	30	36
39	Vehicle dealership/ showroom	53	53	45	35	33	30	31	25	32	23	34	35	30	29	27	33	35	28	39	53
40	Retail store	44	44	37	29	28	25	26	20	26	19	29	29	25	24	23	27	29	23	33	44
41	Other retail	61	62	52	40	39	35	36	29	37	26	40	41	35	34	32	38	40	33	46	62
42	Post office/postal center	54	54	42	36	32	30	32	25	32	22	39	37	35	33	29	38	38	31	44	57
43	Repair shop	12	17	11	12	12	13	17	11	16	10	24	22	18	24	21	21	32	24	40	58
44	Vehicle service/repair shop	15	22	15	16	15	17	22	14	21	13	30	28	24	30	27	27	41	31	52	74
45	Vehicle storage/ maintenance	11	16	11	12	12	13	16	11	16	10	23	21	18	23	20	20	31	23	39	55
46	Other service	17	23	16	17	17	18	24	16	23	14	33	31	25	33	29	29	45	33	56	80
47	Strip shopping mall	95	96	81	63	58	53	54	43	55	40	60	61	53	51	48	57	60	49	69	93
48	Enclosed mall	57	58	49	38	35	32	32	26	33	24	36	36	32	31	29	35	36	30	42	56
49	Bar/pub/lounge	108	106	97	73	72	67	64	61	69	55	69	74	66	56	54	69	61	52	66	82
50	Courthouse/probation office	97	95	84	62	62	52	52	47	52	43	53	52	47	38	36	43	43	35	46	57

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Table B-3a Alternative Building Activity Electricity Site Energy Use Intensity Targets (I-P) *(Continued)*

		Electricity Site Energy Use 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	45	45	35	30	26	25	26	21	27	18	32	31	29	28	25	35	32	26	37	48
52	Single-family detached	38	39	30	26	22	21	22	18	23	15	27	26	25	23	21	26	27	22	31	41
53	Single-family attached	36	36	28	24	21	20	21	17	21	14	26	24	23	22	20	30	26	20	29	38
54	Apartment (in 2 to 4 unit *building*)	42	42	32	28	24	23	24	20	25	17	30	28	27	25	23	44	30	24	34	44
55	Apartment (in 5+ unit *building*)	33	33	26	22	19	18	19	16	20	13	24	23	21	20	18	30	24	19	27	35

Table B-3b Alternative Building Activity Electricity Site Energy Use Intensity Targets (SI)

		Electricity Site Energy Use 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	600	611	518	394	374	334	312	277	326	252	317	333	277	241	237	272	273	225	298	380
2	Bank/other financial	1023	1041	883	673	639	569	532	472	556	429	541	567	473	411	404	463	466	383	508	649
3	Government office	667	679	576	439	417	371	347	308	363	280	353	370	309	268	263	302	304	250	331	423
4	Medical office (nondiagnostic)	593	603	512	390	370	330	308	273	322	248	313	329	274	238	234	268	270	222	294	376
5	Mixed-use office	530	540	458	349	331	295	276	245	288	222	280	294	245	213	209	240	242	199	263	336
6	Other office	503	512	435	331	314	280	262	232	274	211	266	279	233	202	199	228	229	188	250	319
7	Laboratory	1730	1711	1498	1132	1083	969	925	843	972	751	964	1011	861	753	733	868	852	710	932	1194
8	Distribution/shipping center	113	159	108	116	114	124	161	107	154	97	224	209	174	223	197	196	305	228	381	545
9	Nonrefrigerated warehouse	68	96	65	70	69	75	97	64	93	58	135	126	105	135	118	118	184	137	230	328
10	Convenience store	2006	1997	1820	1369	1419	1274	1290	1278	1365	1101	1385	1448	1310	1106	1070	1378	1218	1028	1318	1632
11	Convenience store with gas	2261	2251	2052	1543	1600	1436	1454	1440	1539	1240	1562	1633	1476	1246	1206	1553	1373	1159	1486	1840
12	Grocery store/food market	1818	1811	1650	1241	1287	1155	1169	1158	1237	998	1256	1313	1187	1002	970	1249	1104	932	1195	1479
13	Other food sales	1993	1985	1809	1360	1410	1266	1282	1270	1356	1094	1377	1439	1302	1099	1063	1369	1210	1022	1310	1622
14	Fire station/police station	627	621	543	411	393	351	336	306	353	272	350	367	312	273	266	315	309	257	338	433
15	Other public order and safety	1313	1300	1137	860	823	736	703	640	738	570	732	768	654	572	557	659	647	539	707	907

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Table B-3b Alternative Building Activity Electricity Site Energy Use Intensity Targets (SI) *(Continued)*

		Electricity Site Energy Use 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
16	Medical office (diagnostic)	594	561	570	389	386	371	333	339	372	273	327	370	290	241	255	279	259	236	264	307
17	Clinic/other outpatient health	663	627	637	434	430	414	372	379	415	305	365	413	324	269	284	312	289	263	295	342
18	Refrigerated warehouse	933	923	808	611	584	523	499	455	524	405	520	545	464	406	396	468	460	383	502	644
19	Religious worship	311	308	270	204	195	174	167	152	175	135	174	182	155	136	132	156	153	128	168	215
20	Entertainment/culture	494	489	428	324	310	277	265	241	278	215	276	289	246	215	210	248	244	203	266	341
21	Library	774	766	671	507	485	434	414	377	435	336	432	453	385	337	328	389	381	318	417	535
22	Recreation	563	558	488	369	353	316	301	275	317	245	314	329	280	245	239	283	278	231	303	389
23	Social/meeting	518	512	449	339	324	290	277	252	291	225	289	303	258	226	220	260	255	213	279	358
24	Other public assembly	622	616	539	407	390	349	333	303	350	270	347	364	310	271	264	312	307	255	335	430
25	College/university	1091	1023	817	677	595	520	511	398	521	366	573	560	500	473	427	517	562	445	639	887
26	Elementary/middle school	537	524	444	350	319	288	274	243	286	218	290	303	257	227	220	254	260	215	291	400
27	High school	788	739	591	489	430	376	369	287	376	265	414	405	361	342	309	373	406	322	461	641
28	Preschool/daycare	748	731	619	488	444	402	382	339	398	304	404	423	358	316	306	354	362	300	405	557
29	Other classroom education	453	443	375	295	269	243	231	205	241	184	245	256	217	191	185	214	219	182	245	337
30	Fast food	3940	3885	3635	2667	2681	2523	2370	2321	2568	2071	2535	2709	2372	2038	1992	2478	2253	1907	2446	3038
31	Restaurant/cafeteria	2826	2751	2534	1894	1867	1744	1669	1586	1794	1434	1807	1929	1709	1448	1412	1802	1591	1356	1724	2132
32	Other food service	991	965	889	664	655	612	585	556	629	503	634	676	599	508	495	632	558	476	604	748
33	Hospital/inpatient health	2499	2547	2326	1700	1769	1480	1448	1466	1500	1315	1420	1491	1331	1008	990	1252	1054	912	1071	1214
34	Nursing home/assisted living	1074	1077	831	712	628	588	628	500	636	430	767	728	688	653	583	751	765	611	868	1139
35	Dormitory/ fraternity/sorority	562	564	435	373	328	308	328	262	333	225	401	381	360	342	305	393	400	320	454	596
36	Hotel	658	628	588	427	444	388	385	396	405	333	409	434	380	324	322	397	358	306	385	468
37	Motel or inn	699	688	628	454	437	397	349	359	385	316	341	381	316	258	263	318	278	238	289	339
38	Other lodging	835	821	749	541	522	473	417	429	459	378	407	455	378	308	314	379	332	285	345	404
39	Vehicle dealership/ showroom	598	601	506	395	378	341	352	280	359	257	391	397	342	331	311	373	392	318	448	601
40	Retail store	496	499	419	328	313	282	291	232	298	213	324	329	283	274	258	309	325	264	371	498

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Table B-3b Alternative Building Activity Electricity Site Energy Use Intensity Targets (SI) *(Continued)*

		Electricity Site Energy Use 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	696	700	588	460	439	396	409	326	418	299	455	462	398	385	362	434	456	370	521	699
42	Post office/postal center	613	615	475	407	359	336	359	286	363	246	438	416	393	373	333	429	437	349	496	651
43	Repair shop	136	192	131	140	138	150	194	129	186	117	269	252	210	269	237	236	368	275	460	656
44	Vehicle service/repair shop	174	245	167	179	176	192	248	165	238	149	345	323	268	344	303	302	471	351	588	839
45	Vehicle storage/ maintenance	130	183	125	134	131	143	185	123	178	112	257	241	200	257	226	225	351	262	439	627
46	Other service	188	264	180	193	190	207	267	178	257	161	372	348	289	372	327	326	508	379	634	906
47	Strip shopping mall	1079	1089	917	719	658	601	608	485	628	457	682	689	605	581	540	653	686	557	785	1051
48	Enclosed mall	649	655	552	432	396	361	366	292	378	275	410	414	364	350	325	393	413	335	472	632
49	Bar/pub/lounge	1231	1199	1104	825	814	760	727	691	782	625	787	840	745	631	615	785	693	591	751	929
50	Courthouse/probation office	1098	1074	954	705	708	588	588	537	587	487	604	594	529	435	414	494	487	394	522	652

		Electricity Site Energy Use 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	515	516	399	341	301	282	301	240	305	206	368	349	330	313	280	397	367	293	416	546
52	Single-family detached	437	438	338	290	255	240	255	204	259	175	312	296	280	266	238	292	311	249	353	464
53	Single-family attached	408	409	316	271	238	224	238	190	242	163	291	277	261	248	222	340	291	232	330	433
54	Apartment (in 2 to 4 unit *building*)	476	477	368	316	278	261	278	222	282	191	340	323	305	289	259	494	339	271	385	505
55	Apartment (in 5+ unit *building*)	379	380	293	251	221	208	221	177	224	152	270	257	243	230	206	340	270	216	306	402

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Table B-4a Alternative Building Activity Fossil-Fuel Site Energy Use Intensity Targets (I-P)

		Fossil-Fuel Site Energy Use 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	0	0	0	15	13	14	18	11	13	16	20	14	17	27	25	17	31	30	35	40
2	Bank/other financial	0	0	0	26	22	24	31	20	23	27	33	23	29	47	42	29	53	51	59	68
3	Government office	0	0	0	17	14	15	20	13	15	17	22	15	19	31	27	19	35	33	39	44
4	Medical office (nondiagnostic)	0	0	0	15	13	14	18	11	13	15	19	14	17	27	24	17	31	29	34	39
5	Mixed-use office	0	0	0	13	11	12	16	10	12	14	17	12	15	24	22	15	28	26	31	35
6	Other office	0	0	0	13	11	12	15	10	11	13	16	12	14	23	21	14	26	25	29	33
7	Laboratory	0	0	0	44	37	40	54	35	40	46	59	42	53	86	76	54	97	94	109	125
8	Distribution/shipping center	0	0	0	4	4	5	9	4	6	6	14	9	11	25	20	12	35	30	45	57
9	Nonrefrigerated warehouse	0	0	0	3	2	3	6	3	4	4	8	5	6	15	12	7	21	18	27	34
10	Convenience store	0	0	0	53	48	53	75	53	56	68	85	60	81	126	111	85	139	136	154	171
11	Convenience store with gas	0	0	0	59	54	59	84	60	64	77	96	68	91	142	125	96	157	153	174	192
12	Grocery store/food market	0	0	0	48	44	48	68	48	51	62	77	54	73	114	100	77	126	123	140	155
13	Other food sales	0	0	0	52	48	52	74	53	56	68	85	60	80	125	110	85	138	135	153	169
14	Fire station/police station	0	0	0	16	13	15	19	13	15	17	22	15	19	31	28	19	35	34	39	45
15	Other public order and safety	0	0	0	33	28	30	41	26	31	35	45	32	40	65	58	41	74	71	83	95
16	Medical office (diagnostic)	0	0	0	15	13	15	19	14	15	17	20	15	18	28	26	17	30	31	31	32
17	Clinic/other outpatient health	0	0	0	17	15	17	22	16	17	19	22	17	20	31	29	19	33	35	34	36
18	Refrigerated warehouse	0	0	0	24	20	22	29	19	22	25	32	23	29	46	41	29	52	51	59	67
19	Religious worship	0	0	0	8	7	7	10	6	7	8	11	8	10	15	14	10	17	17	20	22
20	Entertainment/culture	0	0	0	12	11	11	15	10	11	13	17	12	15	25	22	15	28	27	31	36
21	Library	0	0	0	20	16	18	24	16	18	21	27	19	24	38	34	24	44	42	49	56
22	Recreation	0	0	0	14	12	13	17	11	13	15	19	14	17	28	25	17	32	31	35	41
23	Social/meeting	0	0	0	13	11	12	16	10	12	14	18	13	16	26	23	16	29	28	33	37
24	Other public assembly	0	0	0	16	13	14	19	13	14	17	21	15	19	31	27	19	35	34	39	45
25	College/university	0	0	0	26	20	22	30	16	22	23	35	23	31	54	44	32	64	59	75	93

Table B-4a Alternative Building Activity Fossil-Fuel Site Energy Use Intensity Targets (I-P) *(Continued)*

		Fossil-Fuel Site Energy Use 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	0	0	0	13	11	12	16	10	12	13	18	13	16	26	23	16	30	28	34	42
27	High school	0	0	0	19	15	16	21	12	16	16	25	17	22	39	32	23	46	43	54	67
28	Preschool/daycare	0	0	0	19	15	17	22	14	16	19	25	17	22	36	32	22	41	40	47	58
29	Other classroom education	0	0	0	11	9	10	13	8	10	11	15	11	13	22	19	13	25	24	29	35
30	Fast food	0	0	0	103	91	104	137	96	106	128	156	112	147	233	206	153	257	252	286	317
31	Restaurant/cafeteria	0	0	0	73	63	72	97	66	74	89	111	80	106	165	146	111	182	179	201	223
32	Other food service	0	0	0	26	22	25	34	23	26	31	39	28	37	58	51	39	64	63	71	78
33	Hospital/inpatient health	0	0	0	66	60	61	84	61	62	81	87	62	82	115	102	77	120	120	125	127
34	Nursing home/assisted living	0	0	0	27	21	24	36	21	26	27	47	30	43	74	60	46	87	81	101	119
35	Dormitory/ fraternity/sorority	0	0	0	14	11	13	19	11	14	14	25	16	22	39	32	24	46	42	53	62
36	Hotel	0	0	0	16	15	16	22	16	17	21	25	18	23	37	33	25	41	40	45	49
37	Motel or inn	0	0	0	17	15	16	20	15	16	20	21	16	20	29	27	20	32	32	34	35
38	Other lodging	0	0	0	21	18	20	24	18	19	23	25	19	23	35	33	23	38	38	40	42
39	Vehicle dealership/ showroom	0	0	0	15	13	14	20	12	15	16	24	16	21	38	32	23	45	42	52	63
40	Retail store	0	0	0	13	11	12	17	10	12	13	20	14	18	31	27	19	37	35	43	52
41	Other retail	0	0	0	18	15	16	24	13	17	18	28	19	25	44	38	27	52	49	61	73
42	Post office/postal center	0	0	0	16	12	14	21	12	15	15	27	17	24	43	35	27	50	46	58	68
43	Repair shop	0	0	0	5	5	6	11	5	8	7	17	10	13	31	25	15	42	36	54	69
44	Vehicle service/repair shop	0	0	0	7	6	8	14	7	10	9	21	13	17	39	31	19	54	46	69	88
45	Vehicle storage/ maintenance	0	0	0	5	4	6	11	5	7	7	16	10	12	29	23	14	40	35	51	66
46	Other service	0	0	0	7	6	9	15	7	11	10	23	14	18	42	34	20	58	50	74	95
47	Strip shopping mall	0	0	0	28	22	25	35	20	26	28	42	28	37	66	56	40	78	74	92	110
48	Enclosed mall	0	0	0	17	13	15	21	12	16	17	25	17	22	40	34	24	47	44	55	66
49	Bar/pub/lounge	0	0	0	32	28	31	42	29	32	39	48	35	46	72	64	49	79	78	88	97
50	Courthouse/probation office	0	0	0	27	24	24	34	22	24	30	37	25	33	50	43	31	56	52	61	68

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Table B-4a Alternative Building Activity Fossil-Fuel Site Energy Use Intensity Targets (I-P) *(Continued)*

		Fossil-Fuel Site Energy Use 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	0	0	0	13	10	12	17	10	13	13	23	14	20	36	29	25	42	39	49	57
52	Single-family detached	0	0	0	11	9	10	15	8	11	11	19	12	17	30	25	18	36	33	41	48
53	Single-family attached	0	0	0	10	8	9	14	8	10	10	18	11	16	28	23	21	33	31	39	45
54	Apartment (in 2 to 4 unit *building*)	0	0	0	12	9	11	16	9	12	12	21	13	19	33	27	31	39	36	45	53
55	Apartment (in 5+ unit *building*)	0	0	0	10	8	9	13	7	9	9	17	11	15	26	21	21	31	28	36	42

Table B-4b Alternative Building Activity Fossil-Fuel Site Energy Use Intensity Targets (SI)

		Fossil-Fuel Site Energy Use 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	0	0	0	173	145	157	205	130	153	177	222	156	195	312	279	191	354	337	395	452
2	Bank/other financial	0	0	0	294	247	267	349	222	261	301	378	266	332	532	475	325	604	575	674	770
3	Government office	0	0	0	192	161	174	228	145	170	196	247	174	217	347	310	212	394	375	440	502
4	Medical office (nondiagnostic)	0	0	0	171	143	155	202	128	151	174	219	154	192	308	275	188	350	333	390	446
5	Mixed-use office	0	0	0	153	128	138	181	115	135	156	196	138	172	276	246	169	313	298	349	399
6	Other office	0	0	0	145	121	131	172	109	128	148	186	131	163	262	234	160	297	283	332	379
7	Laboratory	0	0	0	495	418	455	608	396	457	527	674	475	604	976	863	609	1104	1065	1236	1417
8	Distribution/shipping center	0	0	0	51	44	58	106	50	73	68	156	98	122	290	231	137	395	342	506	646
9	Nonrefrigerated warehouse	0	0	0	31	27	35	64	30	44	41	94	59	74	174	139	83	238	206	304	389
10	Convenience store	0	0	0	599	548	598	847	600	641	773	968	680	920	1432	1258	968	1578	1543	1748	1937
11	Convenience store with gas	0	0	0	675	618	675	955	677	723	871	1091	767	1037	1614	1418	1091	1778	1739	1971	2183
12	Grocery store/food market	0	0	0	543	497	542	768	544	581	700	877	617	834	1298	1140	877	1430	1399	1585	1756
13	Other food sales	0	0	0	595	545	595	842	596	637	768	962	676	914	1423	1250	962	1568	1533	1737	1925
14	Fire station/police station	0	0	0	180	152	165	220	144	166	191	244	172	219	354	313	221	400	386	448	514
15	Other public order and safety	0	0	0	376	318	346	462	301	347	400	511	361	459	741	655	463	838	809	938	1076

Table B-4b Alternative Building Activity Fossil-Fuel Site Energy Use Intensity Targets (SI) *(Continued)*

		Fossil-Fuel Site Energy Use 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
16	Medical office (diagnostic)	0	0	0	170	149	174	219	159	175	192	228	174	204	313	300	196	335	353	351	364
17	Clinic/other outpatient health	0	0	0	190	166	195	244	178	195	214	255	194	228	349	334	219	374	394	391	406
18	Refrigerated warehouse	0	0	0	267	226	246	328	214	246	284	363	256	326	526	465	329	595	574	666	764
19	Religious worship	0	0	0	89	75	82	109	71	82	95	121	85	109	176	155	110	199	192	222	255
20	Entertainment/culture	0	0	0	142	120	130	174	113	131	151	193	136	173	279	247	174	316	304	353	405
21	Library	0	0	0	222	187	204	272	177	204	236	302	213	271	437	386	273	494	477	553	634
22	Recreation	0	0	0	161	136	148	198	129	149	172	219	155	197	318	281	199	360	347	403	462
23	Social/meeting	0	0	0	148	125	136	182	119	137	158	202	142	181	292	258	182	331	319	370	424
24	Other public assembly	0	0	0	178	151	164	219	142	164	190	242	171	217	351	310	219	397	383	445	510
25	College/university	0	0	0	296	230	244	336	187	245	257	400	263	351	613	502	363	728	668	847	1053
26	Elementary/middle school	0	0	0	153	123	135	180	114	134	153	203	143	180	294	259	178	336	323	386	474
27	High school	0	0	0	214	166	176	243	135	177	186	289	190	253	443	363	262	526	483	612	760
28	Preschool/daycare	0	0	0	213	172	189	251	159	187	213	283	199	251	409	360	248	469	450	538	661
29	Other classroom education	0	0	0	129	104	114	152	96	113	129	171	120	152	248	218	150	284	272	326	400
30	Fast food	0	0	0	1168	1035	1185	1557	1090	1206	1454	1771	1273	1665	2641	2343	1740	2919	2861	3244	3606
31	Restaurant/cafeteria	0	0	0	829	721	819	1096	745	843	1007	1262	906	1200	1876	1661	1265	2062	2035	2286	2531
32	Other food service	0	0	0	291	253	287	384	261	295	353	443	318	421	658	582	444	723	714	802	887
33	Hospital/inpatient health	0	0	0	744	683	695	951	689	705	923	992	700	934	1306	1164	879	1365	1368	1420	1440
34	Nursing home/assisted living	0	0	0	312	242	276	412	235	299	302	536	342	483	846	686	527	991	917	1151	1352
35	Dormitory/ fraternity/sorority	0	0	0	163	127	145	216	123	156	158	280	179	253	443	359	276	519	480	603	708
36	Hotel	0	0	0	187	171	182	253	186	190	233	286	204	267	420	379	279	464	459	510	556
37	Motel or inn	0	0	0	199	169	186	230	169	181	222	238	179	222	334	310	223	360	358	383	402
38	Other lodging	0	0	0	237	201	222	274	201	216	265	285	214	265	399	370	266	429	427	457	480
39	Vehicle dealership/ showroom	0	0	0	173	146	160	231	131	169	180	273	186	240	428	366	262	508	477	594	713
40	Retail store	0	0	0	143	121	133	191	109	140	149	226	155	199	355	304	217	421	396	493	591

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Table B-4b Alternative Building Activity Fossil-Fuel Site Energy Use Intensity Targets (SI) *(Continued)*

		Fossil-Fuel Site Energy Use 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	0	0	0	201	170	186	269	153	196	210	318	217	279	498	426	304	591	555	691	830
42	Post office/postal center	0	0	0	178	138	158	235	134	171	172	306	195	276	483	392	301	566	524	658	772
43	Repair shop	0	0	0	61	53	70	127	60	87	82	188	119	147	349	279	166	477	412	610	779
44	Vehicle service/repair shop	0	0	0	78	68	90	163	77	112	105	241	152	188	446	356	212	610	527	779	996
45	Vehicle storage/ maintenance	0	0	0	59	51	67	122	58	84	78	180	113	141	333	266	158	455	394	582	744
46	Other service	0	0	0	85	73	97	176	83	121	113	260	164	203	481	384	229	658	569	841	1075
47	Strip shopping mall	0	0	0	315	254	282	399	228	295	321	477	324	425	753	635	459	889	836	1041	1247
48	Enclosed mall	0	0	0	189	153	170	240	137	177	193	287	195	255	453	382	276	535	503	626	750
49	Bar/pub/lounge	0	0	0	361	314	357	478	325	367	439	550	395	523	818	724	551	898	887	996	1103
50	Courthouse/probation office	0	0	0	309	273	276	386	252	276	342	422	279	371	564	487	347	631	591	692	774

		Fossil-Fuel Site Energy Use 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	0	0	0	149	116	133	198	113	143	145	257	164	231	405	329	279	475	440	552	648
52	Single-family detached	0	0	0	127	99	113	168	96	122	123	218	139	197	344	279	205	403	373	469	550
53	Single-family attached	0	0	0	118	92	105	157	89	113	115	203	130	183	321	261	239	376	349	437	514
54	Apartment (in 2 to 4 unit *building*)	0	0	0	138	107	123	183	104	132	134	237	152	214	375	304	347	439	407	510	599
55	Apartment (in 5+ unit *building*)	0	0	0	110	86	98	145	83	105	106	189	121	170	298	242	239	350	324	406	477

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

NORMATIVE APPENDIX C
OPERATIONS AND MAINTENANCE IMPLEMENTATION

Informative Note: This appendix is based on ANSI/ASHRAE/ACCA Standard 180 [N18], Section 4, "Implementation," with application to the operations and maintenance of all *building* systems.

C1. INTRODUCTION

This standard is intended to serve all segments of *building* ownership and all methods of delivering inspection and maintenance work. This standard applies to facilities with no maintenance program as well as facilities with state-of-the-art maintenance programs. Requirements are described in terms consistent with a minimum standard. Implementation methods chosen to achieve compliance with this standard are left to the responsible party and/or an authorized implementation partner. All parties may exceed these standard requirements as they see fit.

This standard is implemented by defining the party responsible for compliance and then defining a minimum maintenance program and the elements of the program. These program elements are described and defined to allow compliance to be achieved across the widest range of owners and maintenance delivery systems as reasonably possible.

C2. RESPONSIBLE PARTY

The *building owner* shall be responsible for meeting the requirements of this standard. The owner may designate other parties that shall be authorized and contractually obligated to fulfill the owner's responsibility.

C3. MAINTENANCE PROGRAM

There shall be a maintenance program that preserves the condition and capability of all *building* systems and equipment to enable each to provide the intended *performance* (e.g., thermal and visual comfort, energy efficiency, and indoor environmental quality) required for the facility. At a minimum, the maintenance program shall contain the elements in Sections C3.1 through C6.2.

C3.1 Inventory of Items to be Inspected and Maintained. All *building* systems and equipment that impact *building* envelope *performance*, thermal and visual comfort, energy efficiency, indoor environmental quality, and other services shall be listed in an equipment and component inventory of items to be inspected and maintained. This list shall include manufacturer information, location, capacity, maintenance program identifier, and other data relevant to the equipment or component and agreed upon by the responsible party and implementing party.

C3.2 Maintenance Plan. A plan of inspection and maintenance work shall be established. The maintenance plan shall document the work to be accomplished at scheduled intervals on the inventory of work to be maintained. The maintenance plan shall be developed specifically for the size, design, scope, criticality, and complexity of the systems and equipment serving the facility. The plan shall describe each required task, the frequency of each task, and task schedule; identify the party responsible for performing the task; and specify the authorizing party, task completion documentation procedure, plan monitoring procedures, and procedures for evaluation and feedback. The plan shall include the information described in Sections C3.2.1 through C3.2.4.

C3.2.1 Minimum Required Inspection and Maintenance Tasks. The minimum required inspection and maintenance tasks shall be determined from codes, regulations, and manufacturer recommendations. In any of the aforementioned, all of the tasks that apply to the equipment or components in the maintenance program shall be included in the list of required inspection and maintenance tasks to comply with this standard.

C3.2.2 Inspection and Maintenance Task Frequencies. The baseline frequencies of inspection and maintenance tasks for equipment and systems shall be determined from the sources listed in Section C3.2.1. These frequencies are the minimum required for compliance.

Refer to Section C5 for requirements for revising inspection and maintenance task frequencies.

Informative Note: Inspection serves to monitor and document the condition of equipment and

components over time with regard to appearance, functionality, and *performance*. Maintenance serves to preserve equipment and component condition and *performance* as required by the facility.

C3.2.3 Condition Indicators. Condition indicators for systems and equipment shall be developed. These indicators are measurements or observations of physical condition and delivery of thermal and visual comfort, indoor environmental quality, and energy efficiency that are learned during the *performance* of the related inspection tasks and compared to the condition standard. The comparisons serve to determine the level of

degradation and subsequent responsive action. The responsible party and the maintenance program implementer shall mutually agree on the condition indicators and standards used in the maintenance program.

Informative Note: The intent of this standard is to (a) monitor changes in the condition indicators over time as a measure of the efficacy of the maintenance program in meeting *performance* objectives and (b) provide advance indication of pending equipment or component failures. Unacceptable condition indicators could lead to equipment failure or *performance* degradation. When condition indicators reach unacceptable levels, additional preservative or restorative action is required.

C3.2.4 Maintenance Program Objectives. Program objectives shall be established to define desired outcomes for the maintenance program for all *building* systems and equipment that impact *building* envelope *performance*, and that deliver required thermal and visual comfort, energy efficiency, and indoor environmental quality, and other services. Program objectives shall be measurable quantities that can be trended over time, and shall, when achieved define maintenance program success. Program objectives shall be based on responsible party requirements and operating procedures. The responsible party and the implementing party shall mutually agree on the program objectives. The program objectives shall be documented. Status of program objectives shall be reviewed periodically.

Informative Note: The following sources may assist in establishing specific program objectives based on the Basis of Design and operational criteria specific to a particular system or component:

a. Design documents for the *building* and its systems, with the provision that those documents still reflect the current loads, space utilization, and other system requirements
b. A duly licensed professional authorized to perform design work for the relevant system or component
c. Manufacturers' technical material or generally accepted industry criteria
d. Guidance from ASHRAE Standards 55 [N4], 62.1 [N3], and 90.1 [N2]
e. *Authorities having jurisdiction*
f. Licensed contractor with expertise in the relevant system or component
g. Owner's program requirements

C4. MAINTENANCE PLAN AUTHORIZATION AND EXECUTION

The maintenance plan shall be approved by the responsible party with concurrence by the implementing party. Approval shall authorize performing the work included in the plan.

C4.1 Inspection and maintenance tasks shall be performed at the established frequency or upon documented observance of an unacceptable condition. Whether or not authorized by written or verbal instructions, execution of the task shall be documented and archived for future reference.

Informative Notes:

1. The maintenance plan should include provisions for responding to unplanned inspection and maintenance events.
2. Response to discovery of unacceptable conditions found between task intervals should require authorization to perform the required work with proper documentation. Good practice, once unacceptable conditions are found, is to take action to return equipment to its required condition or *performance* capability. The responsible party and the implementing party must agree on the resource requirements for the work.
3. Unplanned events where additional work beyond the scope of this standard is required, such as repair or replacement, may require additional approval, funding, or authorization by the responsible party and the implementing party for the work to proceed.

C5. REVISION OF THE MAINTENANCE PROGRAM AND MAINTENANCE PLAN

The maintenance program shall be capable of continuous improvement. Improvement in this context shall be manifest when changes in equipment condition or status, changes to the facility, or acquisition of new maintenance technology warrant review and revision of the maintenance plan. The intent of the standard is to enable tasks and/or frequencies to be changed in order to deliver proper preservative action in response to actual conditions.

Informative Notes: The following list contains examples of changes to the facility, its components or

operating systems, and equipment that require review of the maintenance plan:

1. Modifications to the *building* that impact system capacities or configuration
2. Changes to *building* function or *building* use that impact the design intent or configuration of components or systems
3. Changes to *building* systems or components

4. One or more systems found incapable of achieving their design intent or owner requirements
5. Documented, agreed upon recommendations from the responsible party or maintenance provider
6. Miscellaneous changes:
   a. Changes to equipment condition
   b. Changes to equipment status
   c. Changes to the facility
   d. Acquisition of new maintenance technology
   e. Revision to task frequencies in response to actual conditions may result in improved condition or reduced inspection and maintenance work

C5.1 Degradation of Condition and Performance. Degradation of equipment condition or *performance* that is observed while performing scheduled inspection and maintenance tasks or on other occasions shall be documented.

C5.2 Response to Changes. Upon initial discovery or observation of the degraded state, the situation shall be resolved through appropriate corrective or preservative action. If preservative action cannot resolve the degraded status, then further action outside the scope of this standard may be required.

C5.3 If unacceptable condition indicators or unacceptable *performance* are found on a system or component during two successive inspections, the maintenance plan and condition history of the system or component shall be reviewed to determine if the inspection frequency or the maintenance task frequency should be increased. Further, maintenance tasks should also be reviewed for improvement opportunities. Results of the review, and revisions to the maintenance plan, shall be documented and implemented.

C5.4 If acceptable condition indicators or acceptable *performance* are observed during three successive inspections, the maintenance plan shall be reviewed for opportunities to reduce task frequencies or work procedures without compromising condition or *performance*. Revisions to task frequencies and work procedures shall be documented.

C5.5 Climate-related or facility operational requirements may impact execution of the maintenance plan. These circumstances shall be reviewed along with the maintenance plan for opportunities to revise task frequencies or work procedures. Revisions to task frequencies and work procedures shall be documented.

Informative Note: Some of these circumstances may interrupt the delivery of inspection and maintenance care. These deferrals of the maintenance plan provide an opportunity to review existing inspection and maintenance tasks and frequencies and make appropriate adjustments considering the impact of the deferral. Each adjusted frequency should be documented and include the reason for the adjustment.

C5.6 Equipment Warranty. This standard's requirements shall not supersede equipment manufacturers' warranty terms and conditions and other guidance that may require different tasks or task frequencies.

C6. PROGRAM REVIEW

The responsible party and the implementing party shall periodically review the maintenance program. There shall be at least two formal review meetings between the responsible party and the implementing party, one at the beginning of the *performance* period and one at the end of the *performance* period.

C6.1 Beginning Review. The responsible party and the implementing party shall define scope, expectations, and desired outcomes for the maintenance program. Initial review shall consist of developing program objectives, condition standards, and measures to be used to evaluate program *performance* that are mutually acceptable to the responsible party and the implementing party. These factors shall be established before the work commences. Creating *performance* objectives and condition standards ahead of implementation, both authorizing party and implementing party align expectations based on knowledge of the goals and evaluation measures established for the program and maintenance plan.

C6.2 End Review. The end review shall consist of comparing maintenance program results with the program results and condition standards. The responsible party and the implementing party shall review the measurements and observations collected during the evaluation period. The actual results shall be compared to the program requirements, desired outcomes, and *performance* of *building* systems and components. The comparison shall serve to evaluate the maintenance program *performance*. The information shall be used to develop a plan for improving the maintenance program. Program improvement actions shall be mutually agreeable between the responsible party and the implementing party.

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INFORMATIVE APPENDIX D TIMELINE

Compliance will be deemed to be valid for the number of years indicated in the tables below, beginning with the date of the signature on Form A in Normative Appendix A.

For *building*s with *EUI targets*, Table D-1 applies. For *building*s that do not have *EUI targets*, Table D-2 applies.

Table D-1 Compliance Timeline for Buildings with Energy Use Intensity Targets

Event	Time Frame	Reference
Step 1—Determine (a) the *building*'s measured *energy use intensity* (*EUI*) and (b) the *building*'s *EUI target*.	Time 0	Section 4.4.1
Step 2—If *building*'s measured *EUI* is equal to or less than its *EUI target*, go to Step 9. If the *building*'s measured *EUI* is greater than its *EUI target*, continue to Step 3.	Time 0	Section 4.4.2
Step 3—Carry out an energy audit.	0 to 4 months	Sections 4.4.2.3 and 8.3
Step 4—Identify a package of *energy efficiency measures* (*EEMs*) and, assuming their implementation, calculate an adjusted *EUI* for the *building* that is equal to or lower than its *EUI target*.	2 to 6 months	Section 8.3
Step 5—Implement the selected package of *EEMs*.	3 months to 1 year	Sections 8.3 and 9.1.1.1
Step 6—Apply for *conditional compliance*	At completion of Step 5.	Section 4.4.2.3
Step 7—Measure the *building*'s energy use for 12 months and determine its post-*EEM energy use intensity*.	12 to 15 months after completion of Step 5.	Section 4.4.2.4
Step 8—If the *building*'s measured *EUI* is equal to or less than its *EUI target*, go to Step 9. If the *building*'s measured *EUI* is greater than its *EUI target*, return to Step 4, identify additional *EEMs*, and calculate a new adjusted *EUI* that is equal to or lower than the *building*'s *EUI target*.	12 to 15 months after completion of Step 5.	
Step 9—Apply for compliance with Standard 100.	12 to 15 months after completion of Step 5.	Section 4.4.2.1 and Form A

Note: A *building* that achieves compliance shall remain compliant for a period of five years from the date of validation.

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Table D-2 Compliance Timeline for Buildings without Energy Use Intensity Targets

Event	Time Frame	Reference
Step 1—Determine the *building*'s measured *energy use intensity* (*EUI*).	Time 0	Sections 4.4.1 and 5.2
Step 2—Carry out an energy audit. Determine an *optimized bundle* of *energy efficiency measures* (*EEMs*) and calculate the *building*'s adjusted *EUI*.	0 to 6 months	Sections 4.4.3.2 and 8.2
Step 3—Initiate implementation of the *optimized bundle* of *EEMs* identified in the energy audit.	2 to 8 months after completion of Step 2.	Sections 4.4.3.3 and 9.1.1.2
Step 4—Apply for *conditional compliance*.	At completion of Step 3.	Section 4.4.3.3
Step 5—After all *EEMs* have been implemented, measure the *building*'s energy use for 12 months and determine the energy savings from the implemented *EEMs*.	Within 4 years of Step 4	Section 4.4.3.4
Step 6—If the *building*'s measured *EUI* is equal to or less than the adjusted *EUI* from Step 2, go to Step 10. If the *building*'s measured *EUI* is greater than the adjusted *EUI*, but the energy savings from the *EEMs* are at least 75% of the estimated savings from Step 2, go to Step 10. Otherwise, continue to Step 7.	Within 4 years of Step 4	Section 4.4.3.4
Step 7—Identify and implement additional *EEMs* so the *building* will achieve its adjusted *EUI* from Step 2.	2 to 12 months after completion of Step 6.	Sections 4.4.3.4 and 9.1.1.2
Step 8—After all *EEMs* have been implemented, measure the *building*'s energy use for 12 months and determine the energy savings from the implemented *EEMs*.	12 to 15 months after completion of Step 7.	Section 4.4.3.4
Step 9—If the *building*'s measured *EUI* is equal to or less than the adjusted *EUI* from Step 2, go to Step 10. If the *building*'s measured *EUI* is greater than the adjusted *EUI*, but the energy savings from the *EEMs* are at least 75% of the estimated savings from Step 2, go to Step 10. Otherwise, return to Step 7.	12 to 15 months after completion of Step 7.	Section 4.4.3.4
Step 10—Apply for compliance with Standard 100.	Within 60 months after completion of Step 4.	Section 4.4.3.4 and Form A (with additional forms as needed.)

Note: A *building* that achieves compliance shall remain compliant for a period of five years from the date of validation.

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INFORMATIVE APPENDIX E CLIMATE ZONES

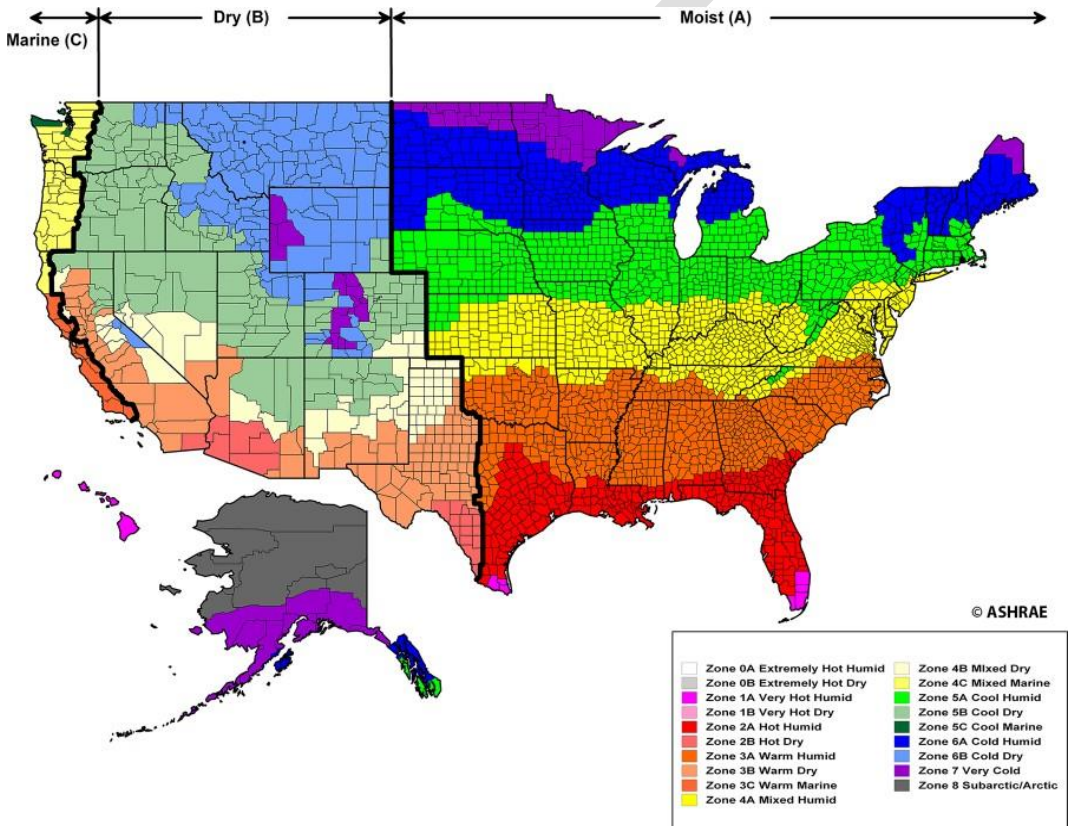

Figure E-1 U.S. climate zone map.

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INFORMATIVE APPENDIX F BUILDING ENERGY MODELING

F1. BUILDING ENERGY MODELING

F1.1 General. *Building* energy simulation plays a valuable role informing the design and operation of existing *buildings* undergoing energy *performance* renovations and in analyzing alternative *energy efficiency measures* (*EEMs*) or for *optimized bundles of EEMs*. *Building* energy simulation can also help prioritize investment strategies and identify the most cost-effective measures.

ANSI/ASHRAE Standard 209, *Energy Simulation Aided Design for Buildings Except Low-Rise Residential Buildings* [N9] was created to define reliable and consistent procedures that advance the use of timely energy modeling to quantify the impact of design decisions at the point in time at which they are being made. The committee believes such an approach will improve modeling effectiveness, realize greater savings, and support achieving increasingly aggressive energy savings targets.

Data from the existing *building* can be used to develop the *baseline* reference *building* model, and that model should be validated against current annual utility costs. The validated model can then be modified to reflect proposed *EEMs*, either individually or collectively, in order to create the proposed *building* model.

Unless specifically impacted by the proposed *EEMs*, the proposed *building* model should be identical to the reference *building* model for all elements, including *building* classification, location, utility rate structure, annual weather data, design-day weather data, and internal design conditions (e.g., summer and winter, form, shape, orientation, envelope, infiltration, interior lighting, *HVAC systems*, ventilation requirements, receptacle load, process loads, occupancy, and operating schedules).

The models can be documented by reports generated by the modeling software or by manually completing relevant compliance forms. Sample compliance forms are included with past editions of the *Standard*
90.1 User's Manual. Simulation software varies in sophistication and detail and includes freeware applications, such as eQUEST (DOE-2) and EnergyPlus, as well as commercial software. End-use-specific tools are available for pumping systems from the DOE's Advance Manufacturing Office.

Utility rate structures and tariffs are published by the Energy Information Agency or can be obtained from your local utilities and energy suppliers.

The energy simulations of the reference *building* and the proposed *building* models must use the same annual hourly weather file, and that file must represent a typical weather year for the current *building* location. The weather file should be selected from the climate zone that most closely represents the typical weather conditions at that location (see Figure E-1). Many simulation programs provide specially formatted versions of the TMY2 or other similar weather files for use with their programs.

ANSI/ASHRAE/IES Standard 90.1 [N2], Normative Appendix G, "Performance Rating Method," provides background modeling and simulation guidance.

Energy models should be developed by qualified professionals and meet the minimum eligibility requirements under the ASHRAE Building Energy Modeling Professional (BEMP) certification program.

The design-day weather data used for sizing equipment represents 99.6% annual cumulative frequency dry-bulb temperature for heating conditions and the 1% annual cumulative frequency dry-bulb and wet-bulb temperatures for cooling conditions. Tables F-1 and F-2 list sources of weather data.

Table F-1 Annual Weather File Sources

Weather File
TMY2—Typical Meteorological Year 2 CTZ2—
California Climate Zone 2

Table F-2 Design-Day Weather Data Sources

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Weather File	Source
ANSI/ASHRAE Standard 169	See Informative Reference N10.
ASHRAE Handbook—Fundamentals	See Informative Reference N11.

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(This appendix is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

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 illustrate example *building* energy efficiency targets in the form of total *building energy use intensities* (*EUIs*) (measured in kBtu/ft^2·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).

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

In this step, national *EUIs* (in kBtu/ft^2·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 *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.

The CBECS database, via a simple parsing method, was found inadequate to provide reliable *EUI* values

by climate zone for a large number of commercial U.S. *building* types. This was primarily due to insufficient sample size when the data were parsed by *building* type and climate zone. A similar problem was noted by

Griffith et al. [N17] As a result, an alternative method was utilized to derive *EUIs* by climate zone. Zonal *EUI* ratios (*EUI* for climate zone/*EUI* national) were provided from *building* simulation modeling performed by NREL[N16] for 16 different climate zones. These ratios are shown in Table G-1 and were used to derive zonal *EUIs* by *building* type by multiplying them by the CBECS national median *EUIs*. This step produced the site-based *building* total *EUIs* by *building* type and climate zone in Table G-3. A similar method was used to derive the zonal *EUIs* for *residential building* types using the RECS database [N13], also listed in Table G-3.

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

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

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

At this point, high-performance *EUI targets* by *building* type for each climate zone had been established. These are the values provided in Tables G-6 and G-7, equivalent but accounted for on a different basis.

In this way, high-performance *EUI targets* were established by *building* type for each climate zone. These results are summarized in Table G-4.

Step 3: Develop Schedule Multipliers

Beyond floor area, another major driver of energy use in *buildings* for many types of commercial *buildings* is operating hours. Table G-5 can be used to account for the impact of different operational shifts when benchmarking a *building* to the Standard 100 targets. Recent analysis shows that this table is directly applicable to the equivalent source-energy-based targets provided in Table G-7.

Derivation of schedule multipliers began with a graphic, histogram-based inspection of the weekly operating hours of all CBECS observations by *building* type (the national sample). From these, three dominant weekly operating hours categories emerged: (a) 50 or fewer weekly operating hours, (b) 168 operating hours, and (c) between 50 and 168 operating hours. Based on these, median national *EUIs* for the CBECS observations in each of these three operational categories were calculated by *building* type. These were then divided by the CBECS national medians by *building* type (for all operational categories) to derive ratios for shift multipliers by *building* type. The resulting shift multipliers are summarized in Table G-5.

BUILDING ENERGY USE TARGETS BY FUEL TYPE

To develop targets by individual fuel type, representative energy use fractions (median values) by energy type and climate zone were derived from the parsed data. These fractions were then multiplied by the total *EUI targets* in Table 7-2 to produce the analogous zonal *building* efficiency targets by fuel type shown in Tables G-8 and G-9.

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Table G-1 Ratios of Climate Zonal EUI to Average of All EUIs by Building Type

ASHRAE Climate Zone:	0A	0B	1A	1B	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
Building Type	**Climate Zone EUI Ratio**																			
All Office	1.20	1.22	1.04	1.14	1.04	0.98	1.03	0.81	0.96	0.86	1.08	0.98	0.95	1.11	1.03	0.93	1.26	1.12	1.39	1.67
Large Office	1.22	1.20	1.06	1.13	1.09	0.96	1.08	0.88	0.96	0.92	1.14	0.97	1.00	1.11	1.00	0.94	1.24	1.10	1.35	1.59
Medium Office	1.22	1.25	1.06	1.17	1.04	1.03	1.02	0.80	0.97	0.83	1.04	0.97	0.91	1.06	1.01	0.89	1.20	1.09	1.31	1.57
Small Office	1.16	1.22	0.99	1.11	0.99	0.95	1.00	0.76	0.95	0.82	1.06	0.99	0.93	1.14	1.08	0.95	1.32	1.19	1.50	1.84
Warehouse	0.41	0.57	0.39	0.60	0.57	0.66	0.96	0.56	0.81	0.59	1.36	1.10	1.06	1.84	1.53	1.20	2.51	2.04	3.18	4.27
Stand-alone Retail	1.01	1.02	0.86	0.96	0.89	0.85	0.99	0.70	0.89	0.74	1.13	0.99	0.99	1.29	1.15	1.08	1.53	1.35	1.77	2.23
Strip Mall	1.08	1.09	0.92	1.03	0.91	0.88	1.01	0.71	0.92	0.78	1.16	1.01	1.03	1.33	1.18	1.11	1.58	1.39	1.83	2.30
Primary School	1.20	1.17	0.99	1.12	0.98	0.94	1.01	0.80	0.93	0.83	1.10	0.99	0.97	1.16	1.07	0.96	1.33	1.20	1.51	1.95
Secondary School	1.29	1.21	0.96	1.15	0.97	0.90	1.00	0.69	0.90	0.74	1.15	0.97	1.00	1.28	1.10	1.04	1.52	1.31	1.75	2.29
Supermarket	0.95	0.94	0.86	0.93	0.93	0.89	1.01	0.89	0.95	0.89	1.11	1.01	1.05	1.20	1.10	1.11	1.32	1.22	1.45	1.69
Fast Food	0.99	0.98	0.92	0.97	0.94	0.93	0.99	0.86	0.95	0.89	1.08	1.00	1.02	1.18	1.09	1.06	1.30	1.20	1.43	1.67
Restaurant	1.01	0.98	0.91	0.97	0.92	0.92	0.99	0.83	0.94	0.87	1.10	1.01	1.04	1.19	1.10	1.10	1.30	1.21	1.43	1.67
Hospital	1.12	1.14	1.04	1.10	1.10	0.98	1.08	0.97	0.99	1.00	1.08	0.98	1.02	1.04	0.97	0.96	1.08	1.02	1.12	1.19
Outpatient Health Care	1.09	1.03	1.04	1.02	0.98	1.00	1.01	0.91	1.00	0.85	1.01	0.99	0.90	1.01	1.01	0.87	1.09	1.08	1.12	1.23
Motel	1.21	1.19	1.09	1.13	1.05	1.01	1.01	0.92	0.98	0.93	1.01	0.97	0.93	1.03	1.00	0.94	1.11	1.03	1.17	1.29
Hotel	1.04	0.99	0.93	0.97	0.97	0.90	1.00	0.92	0.94	0.89	1.09	1.00	1.02	1.17	1.10	1.06	1.29	1.21	1.41	1.61
Mid-Rise Apartment	1.01	1.01	0.78	0.96	0.82	0.81	0.97	0.69	0.88	0.69	1.22	1.00	1.10	1.40	1.19	1.20	1.65	1.43	1.89	2.33

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Table G-2 ASHRAE Climate Zones [N10]

Zone	Thermal Criteria	Representative City
0A	6000 < CDD10°C	Ho Chi Minh City (Vietnam)
0B	6000 < CDD10°C	Dubai (United Arab Emirates)
1A	5000 < CDD10°C ≤ 6000	Miami (U.S.)
1B	5000 < CDD10°C ≤ 6000	New Delhi (India)
2A	3500 < CDD10°C ≤ 5000	Houston (U.S.)
2B	3500 < CDD10°C ≤ 5000	Phoenix (U.S.)
3A	CDD10°C < 3500 and HDD18.3°C ≤ 2000	Atlanta (U.S.)
3B–Coast	CDD10°C < 3500 and HDD18.3°C ≤ 2000	Los Angeles (U.S.)
3B–Other	CDD10°C < 3500 and HDD18.3°C ≤ 2000	Las Vegas (U.S.)
3C	CDD10°C < 3500 and HDD18.3°C ≤ 2000	San Francisco (U.S.)
4A	CDD10°C < 3500 and 2000 < HDD18.3°C ≤ 3000	Baltimore (U.S.)
4B	CDD10°C < 3500 and 2000 < HDD18.3°C ≤ 3000	Albuquerque (U.S.)
4C	CDD10°C < 3500 and 2000 < HDD18.3°C ≤ 3000	Seattle (U.S.)
5A	CDD10°C < 3500 and 3000 < HDD18.3°C ≤ 4000	Chicago (U.S.)
5B	CDD10°C < 3500 and 3000 < HDD18.3°C ≤ 4000	Denver (U.S.)
5C	3000 ≤ HDD18.3°C ≤ 4000	Vancouver (Canada)
6A	4000 < HDD18.3°C ≤ 5000	Minneapolis (U.S.)
6B	4000 < HDD18.3°C ≤ 5000	Helena (U.S.)
7	5000 < HDD18.3°C ≤ 7000	Duluth (U.S.)
8	7000 < HDD18.3°C	Fairbanks (U.S.)

Notes:
1. Climate zones are more fully described in Deru, et al. [N16] and Griffith, et al. [N17]).
2. Representative cities were used for simulation modeling.

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Table G-3 CBECS/RECS Total Site-Based Energy Use Intensities (2012 CBECS/2015 RECS)

		EUIs by Building Type by Climate Zone (kBtu/ft²·yr)																			
		ASHRAE Climate Zone																			
Building Category	**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**
Education	College/university	113	106	85	101	85	79	88	61	79	65	101	85	88	113	96	91	134	115	154	201
Education	Elementary/middle school	56	54	46	52	46	44	47	37	43	38	51	46	45	54	50	45	62	56	70	91
Education	High school	82	77	61	73	62	57	63	44	57	47	73	62	64	81	70	66	97	83	111	145
Education	Other classroom education	47	46	39	44	39	37	40	31	37	32	43	39	38	45	42	38	52	47	59	76
Education	Preschool/daycare	77	76	64	73	64	61	66	52	61	54	71	64	63	75	69	62	86	78	98	126
Enclosed mall	Enclosed mall	67	68	57	64	57	55	63	44	57	49	72	63	64	83	73	69	98	87	114	143
Food sales	Convenience store	208	207	189	204	204	194	221	195	208	194	244	221	231	263	241	243	290	266	318	370
Food sales	Convenience store with gas	234	233	213	230	230	219	250	219	234	219	275	249	260	296	272	274	326	300	358	417
Food sales	Grocery/food market	188	188	171	185	185	176	201	176	188	176	221	200	209	238	219	220	262	241	288	335
Food sales	Other food sales	206	206	187	203	203	193	220	193	207	193	242	219	230	261	240	241	288	265	316	367
Food service	Bar/pub/lounge	128	124	114	123	117	116	125	105	119	110	139	128	131	150	139	138	165	153	181	211
Food service	Fast food	408	402	377	397	385	384	407	353	391	365	446	412	418	485	449	437	536	494	589	688
Food service	Other food service	103	100	92	99	94	93	100	85	96	89	112	103	106	121	112	111	133	123	146	169
Food service	Restaurant/cafeteria	293	285	263	282	268	266	287	241	273	253	318	294	301	344	318	318	378	351	415	483
Hospital	Hospital/inpatient health	259	264	241	253	254	225	248	223	228	232	250	227	235	240	223	221	251	236	258	275
Laboratory	Laboratory	179	177	155	169	156	148	159	128	148	132	170	154	152	179	165	153	203	184	224	270
Lodging	Dormitory/fraternity/sorority	58	58	45	56	47	47	56	40	51	40	71	58	63	81	69	69	95	83	109	135
Lodging	Hotel	68	65	61	64	64	59	66	60	62	59	72	66	67	77	73	70	85	79	93	106
Lodging	Motel or inn	72	71	65	68	63	60	60	55	59	56	60	58	56	61	59	56	66	62	70	77
Lodging	Nursing home/assisted living	111	112	86	106	90	90	108	76	97	76	135	111	121	155	132	132	182	158	209	258
Lodging	Other lodging	86	85	78	81	75	72	72	65	70	67	72	69	67	73	71	67	79	74	83	92
Office	Admin/professional office	62	63	54	59	54	51	54	42	50	44	56	51	49	57	53	48	65	58	72	86
Office	Bank/other financial	106	108	92	100	92	87	91	72	85	76	95	86	83	98	91	82	111	99	122	147
Office	Courthouse/probation office	114	111	99	105	102	89	101	82	89	86	106	90	93	103	93	87	116	102	126	148
Office	Government office	69	70	60	65	60	56	60	47	55	49	62	56	54	64	59	53	72	65	80	96
Office	Medical office (nondiagnostic)	61	62	53	58	53	50	53	42	49	44	55	50	48	57	53	47	64	57	71	85

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Table G-3 CBECS/RECS Total Site-Based Energy Use Intensities (2012 CBECS/2015 RECS) *(Continued)*

		EUIs by Building Type by Climate Zone (kBtu/ft²·yr)																		
		ASHRAE Climate Zone																		
Building Category	**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**
Office	Mixed-use office	55	56	47	52	48	45	47	37	44	39	49	45	43	51	47	42	57	51	63	76
Office	Other office	52	53	45	49	45	43	45	35	42	37	47	42	41	48	45	40	55	49	60	72
Outpatient health care	Clinic/other outpatient health	69	65	66	65	62	63	64	58	63	54	64	63	57	64	64	55	69	68	71	78
Outpatient health care	Medical office (diagnostic)	62	58	59	58	55	57	57	52	57	48	58	56	51	57	57	49	62	61	64	70
Public assembly	Entertainment/culture	51	51	44	48	44	42	45	37	42	38	49	44	43	51	47	44	58	53	64	77
Public assembly	Library	80	79	69	75	70	66	71	57	66	59	76	69	68	80	74	69	91	82	101	121
Public assembly	Other public assembly	64	64	56	61	56	53	57	46	53	48	61	55	55	64	60	55	73	66	81	97
Public assembly	Recreation	58	58	51	55	51	48	52	42	48	43	55	50	49	58	54	50	66	60	73	88
Public assembly	Social/meeting	54	53	46	50	47	44	48	38	44	40	51	46	45	54	50	46	61	55	67	81
Public order	Fire/police station	65	64	56	61	56	54	58	47	54	48	62	56	55	65	60	56	73	67	81	98
Public order	Other public order/safety	136	135	118	128	118	112	121	97	112	101	129	117	115	136	126	116	154	140	170	205
Religious worship	Religious worship	32	32	28	30	28	27	29	23	27	24	31	28	27	32	30	28	36	33	40	49
Retail	Other retail	72	72	61	68	63	60	70	50	64	53	80	70	70	91	82	76	109	96	126	158
Retail	Retail store	51	52	43	49	45	43	50	35	45	38	57	50	50	65	58	54	77	68	90	113
Retail	Vehicle dealership/showroom	62	62	52	59	54	52	60	43	55	45	69	60	60	79	70	66	93	82	108	136
Service	Other service	19	27	19	29	27	31	46	27	39	28	65	53	51	88	74	57	121	98	153	205
Service	Post office/postal center	64	64	49	61	51	51	62	44	55	43	77	63	69	89	75	76	104	90	120	147
Service	Repair shop	14	20	14	21	20	23	33	20	28	21	47	38	37	64	53	42	88	71	111	149
Service	Vehicle service/repair shop	18	25	17	27	25	29	43	25	36	26	61	49	47	82	68	53	112	91	142	190
Service	Vehicle storage/maintenance	13	19	13	20	19	22	32	19	27	20	45	37	35	61	51	40	84	68	106	142
Strip mall	Strip shopping mall	112	113	95	107	94	91	104	74	96	81	120	105	107	138	122	115	163	144	189	238
Warehouse	Distribution/ship center	12	16	11	17	16	19	28	16	24	17	39	32	31	53	44	35	73	59	92	123
Warehouse	Non-refrigerated warehouse	7	10	7	10	10	11	17	10	14	10	24	19	18	32	27	21	44	36	55	74
Warehouse	Refrigerated warehouse	97	96	84	91	84	80	86	69	80	71	92	83	82	97	89	83	109	99	121	146
Residential	Apartment (in 2 to 4 unit *building*)	49	49	38	47	40	40	48	34	43	34	60	49	54	69	58	59	81	70	93	114

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Table G-3 CBECS/RECS Total Site-Based Energy Use Intensities (2012 CBECS/2015 RECS) *(Continued)*

		EUIs by Building Type by Climate Zone (kBtu/ft²·yr)																		
		ASHRAE Climate Zone																		
Building Category	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
Residential	Apartment (in 5+ unit *building*)	39	39	30	37	32	32	38	27	34	27	48	39	43	55	46	47	64	56	74	91
Residential	Mobile/manufactured home	53	53	41	51	43	43	52	37	46	36	65	53	58	74	63	63	87	76	100	124
Residential	Single family-attached	42	42	33	40	34	34	41	29	37	29	51	42	46	59	50	50	69	60	79	98
Residential	Single family-detached	45	45	35	43	37	36	44	31	39	31	55	45	49	63	54	54	74	64	85	105

Table G-4 Energy Use Intensity Targets

		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	44	44	38	41	38	36	37	29	35	31	39	35	34	40	37	34	45	41	50	60
2	Bank/other financial	74	75	64	70	64	61	64	50	59	53	67	60	58	68	64	57	78	69	86	103
3	Government office	48	49	42	46	42	40	42	33	39	35	43	39	38	45	42	37	51	45	56	67
4	Medical office (nondiagnostic)	43	44	37	41	37	35	37	29	34	31	39	35	34	40	37	33	45	40	50	60
5	Mixed-use office	38	39	33	36	33	31	33	26	31	27	35	31	30	35	33	30	40	36	44	53
6	Other office	37	37	32	35	32	30	31	25	29	26	33	30	29	34	31	28	38	34	42	51
7	Laboratory	125	124	109	118	109	103	111	90	104	93	119	108	106	125	116	107	142	129	157	189
8	Distribution/shipping center	8	12	8	12	11	13	19	11	16	12	28	22	21	37	31	24	51	41	64	86
9	Nonrefrigerated warehouse	5	7	5	7	7	8	12	7	10	7	17	13	13	22	19	15	31	25	39	52
10	Convenience store	145	145	132	143	143	136	155	136	145	136	171	154	162	184	169	170	203	186	222	259
11	Convenience store with gas	164	163	149	161	161	153	175	154	164	153	192	174	182	207	190	192	228	210	251	292
12	Grocery store/food market	132	131	120	129	129	123	140	123	132	123	155	140	147	167	153	154	184	169	202	235
13	Other food sales	145	144	131	142	142	135	154	135	145	135	170	153	161	183	168	169	201	185	221	257
14	Fire station/police station	45	45	39	43	40	37	40	33	38	34	43	39	39	45	42	39	51	47	57	69
15	Other public order and safety	95	94	82	90	83	78	84	68	79	70	90	82	81	95	88	81	108	98	119	144

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Table G-4 Energy Use Intensity Targets *(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
16	Medical office (diagnostic)	43	41	41	41	39	40	40	36	40	34	40	39	36	40	40	34	43	43	45	49
17	Clinic/other outpatient health	48	45	46	45	43	44	45	40	44	38	45	44	40	45	45	38	48	48	50	54
18	Refrigerated warehouse	68	67	59	64	59	56	60	48	56	50	64	58	57	68	62	58	77	69	85	102
19	Religious worship	23	22	20	21	20	19	20	16	19	17	21	19	19	23	21	19	26	23	28	34
20	Entertainment/culture	36	35	31	34	31	30	32	26	30	26	34	31	30	36	33	31	41	37	45	54
21	Library	56	56	49	53	49	46	50	40	46	41	53	48	48	56	52	48	64	58	70	85
22	Recreation	41	40	35	38	35	34	36	29	34	30	39	35	35	41	38	35	46	42	51	62
23	Social/meeting	38	37	33	35	33	31	33	27	31	28	36	32	32	38	35	32	42	39	47	57
24	Other public assembly	45	45	39	42	39	37	40	32	37	33	43	39	38	45	42	39	51	46	57	68
25	College/university	79	74	59	71	60	55	61	42	56	45	71	60	62	79	67	64	94	81	108	141
26	Elementary/middle school	39	38	32	36	32	31	33	26	30	27	36	32	32	38	35	31	43	39	49	63
27	High school	57	54	43	51	43	40	44	31	40	33	51	43	45	57	49	46	68	58	78	102
28	Preschool/daycare	54	53	45	51	45	43	46	36	42	37	50	45	44	53	48	44	60	54	68	88
29	Other classroom education	33	32	27	31	27	26	28	22	26	23	30	27	27	32	29	26	36	33	41	53
30	Fast food	286	282	264	278	269	269	285	247	274	256	312	289	293	339	314	306	375	346	413	482
31	Restaurant/cafeteria	205	199	184	197	188	186	201	169	191	177	223	206	211	241	223	222	265	246	291	338
32	Other food service	72	70	64	69	66	65	70	59	67	62	78	72	74	85	78	78	93	86	102	119
33	Hospital/inpatient health	181	185	169	177	178	158	174	156	160	162	175	159	164	168	156	154	175	165	181	192
34	Nursing home/assisted living	78	78	60	74	63	63	75	53	68	53	94	78	85	109	92	93	127	111	146	181
35	Dormitory/ fraternity/sorority	41	41	32	39	33	33	39	28	35	28	49	41	44	57	48	49	67	58	77	95
36	Hotel	48	46	43	44	45	41	46	42	43	41	50	46	47	54	51	49	60	56	65	74
37	Motel or inn	51	50	46	47	44	42	42	38	41	39	42	41	39	43	42	39	46	43	49	54
38	Other lodging	61	60	54	56	52	50	50	46	49	47	50	48	47	51	50	47	55	52	58	64
39	Vehicle dealership/ showroom	43	44	37	41	38	36	42	30	38	32	48	42	42	55	49	46	65	58	76	95
40	Retail store	36	36	30	34	31	30	35	25	32	26	40	35	35	46	41	38	54	48	63	79
41	Other retail	50	51	43	48	44	42	49	35	45	37	56	49	49	64	57	54	76	67	88	111

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Table G-4 Energy Use Intensity Targets *(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
42	Post office/postal center	44	45	34	42	36	36	43	30	39	30	54	44	48	62	53	53	73	63	84	103
43	Repair shop	10	14	9	15	14	16	23	14	20	14	33	27	26	45	37	29	61	50	78	104
44	Vehicle service/repair shop	13	18	12	19	18	20	30	18	25	18	42	34	33	57	48	37	78	64	99	133
45	Vehicle storage/ maintenance	9	13	9	14	13	15	22	13	19	14	32	26	25	43	36	28	58	48	74	99
46	Other service	14	19	13	20	19	22	32	19	27	20	46	37	36	62	52	40	85	69	107	144
47	Strip shopping mall	78	79	67	75	66	64	73	52	67	56	84	73	75	97	85	81	114	101	132	167
48	Enclosed mall	47	48	40	45	40	39	44	31	40	34	51	44	45	58	51	48	69	61	80	100
49	Bar/pub/lounge	89	87	80	86	82	81	87	74	83	77	97	90	92	105	97	97	115	107	127	147
50	Courthouse/probation office	80	78	69	73	71	63	71	57	63	60	74	63	65	72	65	61	81	71	88	103

		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	37	37	29	36	30	30	36	26	32	25	45	37	41	52	44	49	61	53	70	87
52	Single-family detached	32	32	25	30	26	26	31	22	28	22	38	32	35	44	37	36	52	45	60	74
53	Single-family attached	30	30	23	28	24	24	29	20	26	20	36	29	32	41	35	42	48	42	56	69
54	Apartment (in 2 to 4 unit *building*)	35	35	27	33	28	28	33	24	30	24	42	34	38	48	41	61	56	49	65	80
55	Apartment (in 5+ unit *building*)	27	28	21	26	22	22	27	19	24	19	33	27	30	38	32	42	45	39	52	64

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Table G-5 Operating Shift Multipliers

Operating Shift Multipliers					Operating Shift Multipliers				
		Weekly Hours					Weekly Hours		
No.	Building Activity/Type	50 or less	51 to 167	168	No.	Building Activity/Type	50 or less	51 to 167	168
1	Admin/professional office	1.0	1.0	1.4	30	Fast food	0.4	1.1	2.1
2	Bank/other financial	1.0	1.0	1.4	31	Restaurant/cafeteria	0.4	1.1	2.1
3	Government office	1.0	1.0	1.4	32	Other food service	0.4	1.1	2.1
4	Medical office (non-diagnostic)	1.0	1.0	1.4	33	Hospital/inpatient health	1.0	1.0	1.0
5	Mixed-use office	1.0	1.0	1.4	34	Nursing home/assisted living	1.0	1.0	1.0
6	Other office	1.0	1.0	1.4	35	Dormitory/fraternity/sorority	1.0	1.0	1.0
7	Laboratory	1.0	1.0	1.0	36	Hotel	1.0	1.0	1.0
8	Distribution/shipping center	0.7	1.4	2.1	37	Motel or inn	1.0	1.0	1.0
9	Nonrefrigerated warehouse	0.7	1.4	2.1	38	Other lodging	1.0	1.0	1.0
10	Convenience store	1.0	1.0	1.4	39	Vehicle dealership/showroom	0.8	1.2	1.8
11	Convenience store with gas	1.0	1.0	1.4	40	Retail store	0.8	1.2	1.8
12	Grocery/food market	1.0	1.0	1.4	41	Other retail	0.8	1.2	1.8
13	Other food sales	1.0	1.0	1.4	42	Post office/postal center	0.7	1.5	1.5
14	Fire/police station	0.8	0.8	1.1	43	Repair shop	0.7	1.5	1.5
15	Other public order/safety	0.8	0.8	1.1	44	Vehicle service/repair shop	0.7	1.5	1.5
16	Medical office (diagnostic)	1.0	1.0	1.5	45	Vehicle storage/maintenance	0.7	1.5	1.5
17	Clinic/other outpatient health	1.0	1.0	1.5	46	Other service	0.7	1.5	1.5
18	Refrigerated warehouse	1.0	1.0	1.0	47	Strip shopping mall	1.0	1.0	1.0
19	Religious worship	0.9	1.7	1.7	48	Enclosed mall	1.0	1.0	1.0
20	Entertainment/culture	0.8	1.5	1.5	49	Bar/pub/lounge	1.0	1.0	1.4
21	Library	0.8	1.5	1.5	50	Courthouse/probation office	1.0	1.0	1.4
22	Recreation	0.8	1.5	1.5		**Residential Building Activity/Type**			
23	Social/meeting	0.8	1.5	1.5	51	Mobile home	1.0	1.0	1.0
24	Other public assembly	0.8	1.5	1.5	52	Single-family detached	1.0	1.0	1.0
25	College/university	0.8	1.3	1.3	53	Single-family attached	1.0	1.0	1.0
26	Elementary/middle school	0.8	1.3	1.3	54	Apartment *building* (2–4 units)	1.0	1.0	1.0
27	High school	0.8	1.3	1.3	55	Apartment *building* (5+ units)	1.0	1.0	1.0
28	Preschool/daycare	0.8	1.3	1.3					
29	Other classroom education	0.8	1.3	1.3					

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Table G-6 Building Total Energy Use Targets (Site Energy)

Energy Use Targets by Building Activity (EUI) (I-P Units)[1]																		
No.	Commercial Building Type	EUIs by Building Type by Climate Zone (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	39	40	39	42	33	39	33	46	40	40	48	42	39	54	47	58	81
2	Bank/other financial	55	57	56	59	46	55	47	65	56	57	68	59	56	76	67	82	115
3	Government office	49	50	49	52	41	48	42	57	49	50	60	52	49	67	59	72	101
4	Medical office(non-diagnostic)	33	34	33	35	28	33	28	39	34	34	41	36	33	46	40	49	69
5	Mixed-use office	45	46	45	48	38	45	39	53	46	47	56	48	45	62	55	67	94
6	Other office	38	39	38	40	32	37	32	44	38	39	47	40	38	52	46	56	78
7	Laboratory	178	176	171	175	147	165	159	194	173	179	209	187	181	232	211	249	331
8	Distribution/shipping center	12	16	16	20	11	18	14	27	23	22	36	30	24	49	40	60	113
9	Nonrefrigerated warehouse	6	8	8	10	5	9	7	13	11	11	17	14	12	24	19	29	54
10	Convenience store	135	146	135	152	127	139	141	166	150	157	178	162	167	193	179	208	263
11	Convenience store with gas	108	118	109	122	102	112	114	133	121	126	144	130	135	156	144	168	212
12	Grocery store/food market	112	122	113	127	106	116	118	138	125	131	149	135	139	161	149	174	219
13	Other food sales	34	37	34	38	32	35	36	42	38	40	45	41	42	49	45	53	66
14	Fire station/police station	66	65	63	64	54	61	59	71	64	66	77	69	67	85	78	92	122
15	Other public order and safety	60	59	57	59	49	55	53	65	58	60	70	63	61	78	71	84	111
16	Medical office (diagnostic)	33	32	32	32	30	32	27	32	30	28	30	30	28	31	30	31	35
17	Clinic/other outpatient health	50	48	49	48	45	48	40	48	46	42	46	45	42	47	45	46	52
18	Refrigerated warehouse	69	68	66	68	57	64	62	75	67	69	81	72	70	90	82	96	128
19	Religious worship	23	23	22	23	19	22	21	25	23	23	27	25	24	30	28	33	43
20	Entertainment/culture	23	23	22	23	19	21	21	25	23	23	27	24	24	30	28	32	43
21	Library	61	61	59	60	50	57	55	67	60	61	72	64	62	80	73	86	114
22	Recreation	26	26	25	26	22	24	24	29	26	26	31	28	27	34	31	37	49
23	Social/meeting	28	27	26	27	23	26	25	30	27	28	32	29	28	36	33	39	51
24	Other public assembly	28	28	27	28	23	26	25	31	27	28	33	30	29	37	33	39	52
25	College/university	62	61	60	62	45	58	50	72	60	65	78	65	65	90	78	99	147
26	Elementary/middle school	38	37	36	37	30	35	32	41	36	36	42	37	35	46	41	49	72
27	High school	45	45	44	46	33	42	37	52	44	47	57	48	47	66	57	72	107
28	Preschool/daycare	49	48	46	48	39	45	41	52	46	47	54	47	46	60	53	63	93
29	Other classroom education	25	25	25	25	18	24	21	29	25	26	32	27	27	37	32	40	60
30	Fast food	261	268	263	277	237	266	253	305	280	284	332	301	295	364	333	393	497
31	Restaurant/cafeteria	141	145	141	150	126	143	137	166	151	156	179	163	166	195	181	213	268
32	Other food service	77	79	77	82	69	78	75	91	83	85	98	89	91	107	99	116	146
33	Hospital/inpatient health	142	143	140	141	134	138	130	143	129	135	139	126	135	142	130	144	166
34	Nursing home/assisted living	84	83	81	83	69	78	75	91	82	84	99	88	85	109	100	118	156
35	Dormitory/fraternity/sorority	40	43	42	47	31	43	40	58	48	54	65	55	52	75	66	85	119
36	Hotel	50	51	48	52	47	49	48	55	52	52	57	55	53	61	59	65	75
37	Motel or inn	55	53	52	51	48	50	46	52	50	48	53	50	49	56	52	57	69
38	Other lodging	53	50	50	49	46	48	44	49	48	46	50	48	47	53	50	55	66
39	Vehicle dealership/showroom	49	50	49	53	38	48	42	60	52	52	68	58	58	78	69	87	124
40	Retail store	28	29	28	30	21	27	24	34	30	30	39	33	33	45	40	50	71
41	Other retail	49	50	49	52	37	48	42	59	52	52	67	58	57	78	69	86	124
42	Post office/postal center	43	42	41	42	35	39	38	46	41	43	50	45	43	56	51	60	79
43	Repair shop	28	28	27	28	23	26	25	31	28	28	33	30	29	37	34	40	53
44	Vehicle service/repair shop	33	33	32	32	27	31	29	36	32	33	39	35	33	43	39	46	61
45	Vehicle storage/maintenance	14	14	14	14	12	13	13	16	14	14	17	15	15	19	17	20	27
46	Other service	60	60	58	59	50	56	54	65	59	60	71	63	61	78	71	84	112
47	Strip shopping mall	59	59	58	62	46	57	51	71	62	63	82	70	71	94	84	106	151
48	Enclosed mall	56	56	55	59	44	54	49	68	59	60	78	67	68	90	80	101	144
49	Mobile home	38	40	40	45	30	41	38	54	45	51	62	52	49	71	62	80	112
50	SF-detached	28	30	30	33	22	30	28	40	34	38	46	38	36	52	46	60	83
51	SF-attached	32	34	34	38	25	35	32	46	39	43	53	44	42	60	53	69	96
52	Aptmt-in 2-4 unit	47	50	50	56	37	51	47	68	57	64	77	65	61	89	78	101	140
53	Aptmt in 5+ unit	32	34	34	38	25	35	32	46	39	43	53	44	42	60	53	68	96

[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.)

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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/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).

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Comment on Chapters 4-6: https://odoe.powerappsportals.us/en-US/bps-5-22-2024/

Table G-8 Building Electricity Use Targets

Energy Use Targets by Building Activity (EUI) (I-P Units)[1]																		
No.	Commercial Building Type	Electric EUIs by Building Type by Climate Zone (kBtu/ft^2-yr)																
		ASHRAE Climate Zone																
		1A	2A	2B	3A	3B Coas	3B Othe	3C	4A	4B	4C	5A	5B	5C[2]	6A	6B	7	8
1	Admin/professional office	39	40	34	41	29	34	28	29	23	36	19	22	24	21	21	22	31
2	Bank/other financial	55	57	49	58	41	48	39	41	33	51	26	31	34	29	29	31	44
3	Government office	49	50	43	51	36	42	35	36	29	45	23	27	30	26	26	28	39
4	Medical office(non-diagnostic)	33	34	29	35	24	29	24	24	20	31	16	18	20	17	18	19	26
5	Mixed-use office	45	46	40	48	33	39	32	33	27	41	22	25	27	24	24	26	36
6	Other office	38	39	33	40	28	33	27	28	22	35	18	21	23	20	20	21	30
7	Laboratory	178	176	149	173	128	144	132	122	101	159	81	97	110	89	93	95	127
8	Distribution/shipping center	12	16	14	20	9	16	12	17	13	19	14	16	15	19	18	23	43
9	Nonrefrigerated warehouse	6	8	7	10	5	8	6	8	6	9	7	8	7	9	9	11	21
10	Convenience store	135	146	118	151	111	121	118	105	87	139	69	84	101	74	78	80	101
11	Convenience store with gas	108	118	95	121	89	98	95	84	70	112	56	68	82	60	63	64	81
12	Grocery store/food market	112	122	99	126	92	101	98	87	73	116	57	70	84	62	65	67	84
13	Other food sales	34	37	30	38	28	31	30	26	22	35	17	21	26	19	20	20	25
14	Fire station/police station	66	65	55	64	47	53	49	45	37	58	30	36	41	33	34	35	47
15	Other public order and safety	60	59	50	58	43	48	44	41	34	53	27	33	37	30	31	32	43
16	Medical office (diagnostic)	33	32	28	32	26	28	22	20	18	25	12	15	17	12	13	12	13
17	Clinic/other outpatient health	50	48	43	48	39	42	33	30	27	38	18	23	26	18	20	18	20
18	Refrigerated warehouse	69	68	58	67	50	56	51	47	39	61	31	38	43	34	36	37	49
19	Religious worship	23	23	20	23	17	19	17	16	13	21	11	13	15	12	12	13	17
20	Entertainment/culture	23	23	19	23	17	19	17	16	13	21	11	13	15	12	12	12	17
21	Library	61	61	51	60	44	50	45	42	35	55	28	33	38	31	32	33	44
22	Recreation	26	26	22	26	19	21	20	18	15	24	12	14	16	13	14	14	19
23	Social/meeting	28	27	23	27	20	22	20	19	16	25	12	15	17	14	14	15	20
24	Other public assembly	28	28	24	27	20	23	21	19	16	25	13	15	18	14	15	15	20
25	College/university	62	61	53	62	39	51	42	45	35	57	30	34	39	35	34	38	56
26	Elementary/middle school	38	37	31	37	27	30	27	26	21	32	16	19	21	18	18	19	28
27	High school	45	45	38	45	29	37	31	33	26	42	22	25	29	25	25	28	41
28	Preschool/daycare	49	48	40	48	34	39	34	33	27	41	21	25	28	23	23	24	36
29	Other classroom education	25	25	21	25	16	21	17	19	14	23	12	14	16	14	14	16	23
30	Fast food	261	268	230	275	207	232	210	193	163	252	128	156	179	139	146	151	191
31	Restaurant/cafeteria	141	145	123	149	110	125	114	105	88	138	69	84	101	75	79	82	103
32	Other food service	77	79	67	82	60	68	62	57	48	76	38	46	55	41	43	45	56
33	Hospital/inpatient health	142	143	122	140	117	121	108	90	75	120	54	66	82	55	57	55	64
34	Nursing home/assisted living	84	83	70	82	61	68	62	58	48	75	38	46	52	42	44	45	60
35	Dormitory/fraternity/sorority	40	43	37	47	28	38	33	36	28	48	25	29	32	29	29	33	46
36	Hotel	50	51	42	51	41	43	40	34	30	46	22	28	32	23	26	25	29
37	Motel or inn	55	53	46	50	42	44	39	33	29	42	20	26	30	21	23	22	26
38	Other lodging	53	50	44	48	40	42	37	31	28	41	20	25	29	20	22	21	25
39	Vehicle dealership/showroom	49	50	43	52	33	42	35	38	30	46	26	30	35	30	30	33	48
40	Retail store	28	29	24	30	19	24	20	22	17	26	15	17	20	17	17	19	27
41	Other retail	49	50	43	52	33	42	35	37	30	46	26	30	35	30	30	33	47
42	Post office/postal center	43	42	36	42	31	35	32	29	24	38	19	23	26	21	22	23	30
43	Repair shop	28	28	24	28	20	23	21	19	16	25	13	15	18	14	15	15	20
44	Vehicle service/repair shop	33	33	28	32	24	27	24	23	19	29	15	18	20	16	17	18	23
45	Vehicle storage/maintenance	14	14	12	14	10	12	11	10	8	13	6	8	9	7	7	8	10
46	Other service	60	60	50	59	43	49	45	41	34	54	27	33	37	30	31	32	43
47	Strip shopping mall	59	59	50	62	40	50	42	45	36	56	32	36	43	36	37	41	58
48	Enclosed mall	56	56	48	59	38	47	40	43	34	54	30	35	41	34	35	39	55
49	Mobile home	38	40	35	44	26	36	31	34	27	45	24	27	30	27	27	31	43
50	SF-detached	28	30	26	33	19	26	23	25	20	33	18	20	22	20	20	23	32
51	SF-attached	32	34	30	38	22	30	27	29	23	39	20	23	26	23	23	26	37
52	Aptmt-in 2-4 unit	47	50	44	55	32	45	39	43	33	57	30	34	37	34	34	39	54
53	Aptmt in 5+ unit	32	34	30	38	22	30	27	29	23	38	20	23	26	23	23	26	37

[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.)

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Table G-9 Building Fossil-Fuel Use Targets

Building Activity Electricity Targets (EUI) (I-P Units)[1]																		
No.	Commercial Building Type	Fossil Fuel EUIs by Building Type by Climate Zone (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	0	0	5	0.4	4	5	6	17	16	5	30	20	15	33	27	36	50
2	Bank/other financial	0	0	7	0.5	6	7	8	24	23	6	42	28	22	47	38	51	71
3	Government office	0	0	6	0.5	5	6	7	21	21	6	37	25	19	41	33	44	62
4	Medical office(non-diagnostic)	0	0	4	0.3	4	4	5	14	14	4	25	17	13	28	23	30	43
5	Mixed-use office	0	0	6	0.4	5	6	7	19	19	5	34	23	18	38	31	41	58
6	Other office	0	0	5	0.4	4	5	5	16	16	4	29	19	15	32	26	34	48
7	Laboratory	0	0	21	1.5	18	21	27	71	72	20	128	90	71	143	119	154	204
8	Distribution/shipping center	0	0	2	0.2	1	2	2	10	9	2	22	14	9	30	23	37	69
9	Nonrefrigerated warehouse	0	0	1	0.1	1	1	1	5	5	1	11	7	5	15	11	18	34
10	Convenience store	0	0	17	1.3	16	17	24	61	62	18	109	78	66	119	100	129	162
11	Convenience store with gas	0	0	14	1.1	13	14	19	49	50	14	88	63	53	96	81	104	131
12	Grocery store/food market	0	0	14	1.1	13	15	20	51	52	15	91	65	55	99	84	107	135
13	Other food sales	0	0	4	0.3	4	4	6	15	16	4	28	20	16	30	25	32	41
14	Fire station/police station	0	0	8	0.6	7	8	10	26	27	7	47	33	26	53	44	57	75
15	Other public order and safety	0	0	7	0.5	6	7	9	24	24	7	43	30	24	48	40	52	68
16	Medical office (diagnostic)	0	0	4	0.3	4	4	5	12	13	3	19	14	11	19	17	19	22
17	Clinic/other outpatient health	0	0	6	0.4	6	6	7	18	19	5	28	21	16	29	25	28	32
18	Refrigerated warehouse	0	0	8	0.6	7	8	10	28	28	8	50	35	27	55	46	59	79
19	Religious worship	0	0	3	0.2	2	3	4	9	9	3	17	12	9	19	16	20	27
20	Entertainment/culture	0	0	3	0.2	2	3	3	9	9	3	17	12	9	19	15	20	27
21	Library	0	0	7	0.5	6	7	9	25	25	7	44	31	24	49	41	53	70
22	Recreation	0	0	3	0.2	3	3	4	11	11	3	19	13	11	21	18	23	30
23	Social/meeting	0	0	3	0.2	3	3	4	11	11	3	20	14	11	22	18	24	32
24	Other public assembly	0	0	3	0.2	3	3	4	11	11	3	20	14	11	23	19	24	32
25	College/university	0	0	8	0.6	6	7	9	27	25	7	48	31	26	56	44	61	91
26	Elementary/middle school	0	0	5	0.3	4	4	5	15	15	4	26	18	14	28	23	30	44
27	High school	0	0	6	0.4	4	5	6	19	18	5	35	23	18	41	32	45	66
28	Preschool/daycare	0	0	6	0.4	5	6	7	19	19	5	33	23	18	37	30	39	57
29	Other classroom education	0	0	3	0.2	2	3	3	11	10	3	20	13	11	23	18	25	37
30	Fast food	0	0	33	2.4	30	33	43	113	117	32	203	145	116	224	187	242	306
31	Restaurant/cafeteria	0	0	18	1.3	16	18	23	61	63	17	110	78	65	121	101	131	165
32	Other food service	0	0	10	0.7	9	10	13	33	34	10	60	43	36	66	55	72	90
33	Hospital/inpatient health	0	0	18	1.2	17	17	22	53	54	15	85	61	53	88	73	89	102
34	Nursing home/assisted living	0	0	10	0.7	9	10	13	34	34	9	60	42	33	67	56	72	96
35	Dormitory/fraternity/sorority	0	0	5	0.4	4	5	7	21	20	6	40	26	20	46	37	53	73
36	Hotel	0	0	6	0.5	6	6	8	20	22	6	35	26	21	38	33	40	46
37	Motel or inn	0	0	7	0.5	6	6	8	19	21	5	32	24	19	34	29	35	42
38	Other lodging	0	0	6	0.4	6	6	7	18	20	5	31	23	18	33	28	34	40
39	Vehicle dealership/showroom	0	0	6	0.5	5	6	7	22	22	6	41	28	23	48	39	53	77
40	Retail store	0	0	4	0.3	3	3	4	13	12	3	24	16	13	28	22	31	44
41	Other retail	0	0	6	0.5	5	6	7	22	21	6	41	28	22	48	39	53	76
42	Post office/postal center	0	0	5	0.4	4	5	6	17	17	5	31	22	17	34	28	37	49
43	Repair shop	0	0	3	0.2	3	3	4	11	12	3	20	14	11	23	19	25	33
44	Vehicle service/repair shop	0	0	4	0.3	3	4	5	13	13	4	24	17	13	26	22	28	38
45	Vehicle storage/maintenance	0	0	2	0.1	1	2	2	6	6	2	10	7	6	11	10	12	16
46	Other service	0	0	7	0.5	6	7	9	24	24	7	43	30	24	48	40	52	69
47	Strip shopping mall	0	0	7	0.5	6	7	9	26	26	7	50	34	28	58	47	65	93
48	Enclosed mall	0	0	7	0.5	5	7	8	25	25	7	48	32	27	55	45	62	89
49	Mobile home	0	0	5	0.4	4	5	6	20	19	6	38	25	19	44	35	49	69
50	SF-detached	0	0	4	0.3	3	4	5	15	14	4	28	18	14	32	26	37	51
51	SF-attached	0	0	4	0.3	3	4	5	17	16	5	32	21	16	37	30	42	59
52	Aptmt-in 2-4 unit	0	0	6	0.5	5	6	8	25	24	7	47	31	24	55	44	62	87
53	Aptmt in 5+ unit	0	0	4	0.3	3	4	5	17	16	5	32	21	16	37	30	42	59

[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.)

(This appendix is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

INFORMATIVE APPENDIX H ENERGY EFFICIENCY MEASURES

This informative appendix provides categorized listings of typical *energy efficiency measures* (*EEMs*) that can be applied to enable *buildings* to meet the set *energy use intensity (EUI) targets*. It identifies commonly applied elements that can improve *building performance* but is not intended to suggest specific requirements, nor does it comprehensively covered all of the options available to an owner.

Measures included in these listings are intended to improve energy efficiency and reduce overall energy use. They are not intended to encourage fuel switching unless actions such as installation of cogeneration, trigeneration, or combined heating and cooling plants would result in overall reduction in total energy used. Some measures, such as demand response/control, may also save energy as an incidental benefit. Other measures may result in extension of the capacity of given infrastructure systems and/or the ability for energy efficiency to defer or eliminate the need for plant expansions. Such results can be factored into the resulting return on investment or life-cycle cost analysis.

H1. BUILDING ENVELOPE

H1.1 Walls

H1.1.1 Insulate Walls. Retrofit insulation can be external and internal.

H1.1.1.1 External post insulation makes large savings possible, as this type of insulation contributes not only to a reduction of the heat loss through large wall surfaces but also eliminates the traditional thermal bridges where floor and internal wall are anchored in the exterior wall.

H1.1.1.2 Internal insulation is typically used when external insulation is not allowed, such as for historical *buildings*.

H1.1.2 Insulate cavity walls using spray-in insulation.

H1.1.3 Consider converting internal courtyard into an atrium to reduce external wall surface.

H1.2 Roofs

H1.2.1 Use cool roof (high-reflectance roofing material) with reroofing projects.

H1.2.2 Determine roof insulation values and recommend roof insulation as appropriate. **H1.2.3** Insulate ceilings and roofs using spray-on insulation.

H1.2.4 Where appropriate, exhaust hot air from attics.

H1.3 Floors

H1.3.1 Insulate floors.

H1.3.2 Insulate floors using spray-on insulation.

H1.3.3 Insulate basement wall with a slab over unheated basement.

H1.4 Windows

H1.4.1 Replace single-pane and leaky windows with thermal/operable windows to minimize cooling and heating loss.

H1.4.2 Install exterior shading, such as blinds or awnings, to cut down on heat loss and to reduce heat gain.

H1.4.3 Install storm windows and multiple glazed windows.

H1.4.4 Use tinted or reflective glazing or energy control/solar window films.

H1.4.5 Replace existing fenestration (toplighting and/or sidelighting) with dual-glazed low-e glass wherever possible to reduce thermal gain.

H1.4.6 Adopt weatherization/fenestration improvements.

H1.4.7 Consider replacing exterior windows with insulated glass block when visibility is not required but light is required.

H1.4.8 Landscape/plant trees to create shade and reduce air-conditioning loads.

H1.5 Doors

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H1.5.1 Prevent heat loss through doors by draft sealing and using thermal insulation.

H1.5.2 Install automatic doors, air curtains, or strip doors at high-traffic passages between conditioned and unconditioned spaces.

H1.5.3 Use self-closing or revolving doors and vestibules if possible.

H1.5.4 Install high-speed doors between heated/cooled *building* space and unconditioned space in the areas with high-traffic passages.

H1.6 Install separate smaller doors for people near the area of large vehicle doors.

H1.6.1 Seal top and bottom of *building*.

H1.6.2 Seal vertical shafts, stairways, outside walls, and openings.

H1.6.3 Compartmentalize garage doors and mechanical and vented internal and special-purpose rooms.

H1.7 Moisture Penetration H1.8

Reduce air leakage.

H1.9 Install vapor barriers in walls, ceilings, and roofs.

H2. HVAC SYSTEMS

H2.1 Ventilation

H2.1.1 Reduce *HVAC system* outdoor airflow rates when possible. Minimum outdoor airflow rates should comply with ANSI/ASHRAE Standard 62.1 [N3] or local code requirements.

H2.1.2 Reduce minimum flow settings in single-duct and dual-duct variable-air-volume (VAV) terminals as low as is practical to meet ventilation requirements.

H2.1.3 Minimize exhaust and makeup (ventilation) rates when possible by complying with the most stringent federal, state, and/or local code requirements.

H2.1.4 When available, use operable windows for ventilation during mild weather (natural ventilation) when outdoor conditions are optimal. Confirm that the facility has been designed for natural ventilation and that control strategies are available to operate the facility in the natural ventilation mode.

H2.1.5 Eliminate outdoor air ventilation during unoccupied *building* morning warm up.

H2.1.6 Convert mixing air supply systems into displacement ventilation systems to create a temperature stratification in spaces with high ceilings and predominant cooling needs.

H2.1.7 Consider replacement of all-air *HVAC system* with a combination of a dedicated outdoor air system (DOAS) coupled with radiant cooling and heating systems.

H2.1.8 Convert constant-air-volume (CAV) central exhaust systems into demand-based controlled central exhaust systems when possible.

H2.1.9 Convert *HVAC systems* to provide ventilation in accordance with ASHRAE Standard 62.1 [N3].

H2.2 HVAC Distribution Systems

H2.2.1 Convert a CAV (including dual-duct, multizone, and constant-volume reheat systems) into a VAV system with variable-frequency drives (VFDs) on fan motors. A VAV system is designed to deliver only the volume of air needed for conditioning the actual load.

H2.2.2 Control VAV system VFD speed based on the static pressure needs in the system. Reset the static pressure set point dynamically as low as is practical to meet the *zone* set points.

H2.2.3 Reset VAV system supply air temperature set point when system is at minimum speed to provide adequate ventilation.

H2.2.4 If conversion to VAV from CAV systems is impractical, reset supply air temperatures in response to load. Dynamically control heating duct temperatures as low as possible, and cooling duct temperatures as high as possible, while meeting the load.

H2.2.5 Use high-efficiency fans and pumps; replace or trim impellers of existing fans if they have excessive capacity relative to peak demand.

H2.2.6 Install higher-efficiency air filters/cleaners in the *HVAC system*. Size ducts and select filter sizes for low face velocity to reduce pressure drop where available space permits.

H2.2.7 Insulate HVAC ducts and pipes, particularly where they are outside the *conditioned space*. Ensure that duct insulation and vapor barrier are maintained or enhanced to ensure thermal *performance* and avoid water vapor intrusion.

H2.2.8 Check for air leaks in HVAC duct systems and seal ductwork as indicated.

H2.2.9 Rebalance ducting and piping systems.

H2.2.10 Provide cooling effect by creating air movement with fans.

H2.2.11 Select cooling coils with a face velocity range of 300 to 350 fpm (1.5 to 1.75 m/s) to reduce the air pressure drop across the cooling coil and increase the chilled-water system temperature differential across the system.

H2.2.12 Replace standard fan belts with fan belts designed for minimum energy losses, such as cog belts.

H2.2.13 Eliminate or downsize existing HVAC equipment in an existing *building* or group of *buildings* when improvements in *building* envelope, reductions in lighting or plug loads, and other *EEMs* that reduce cooling or heating loads have been implemented.

H2.2.14 Eliminate HVAC use in vestibules and unoccupied spaces.

H2.2.15 Minimize direct cooling/heating of unoccupied areas by system *zone* controls, *occupancy sensors*, or by turning off fan-coil units and unit heaters.

H2.2.16 Replace forced-air heaters with low- or medium-temperature radiant heaters.

H2.2.17 Replace inefficient window air conditioners with high-efficiency (i.e., high SEER rating) modular units or central systems.

H2.2.18 Employ heat recovery from exhaust air and processes for preheating or precooling incoming outdoor air or supply air.

H2.2.19 Install transpired air heating collector (solar wall) for ventilation air preheating.

H2.2.20 Modify controls and/or systems to implement night precooling to reduce cooling energy consumption the following day.

H2.2.21 Use waste heat, such as hot gas, return air heat, or return hot water, as an energy source for reheating for humidity control. (Often air is cooled to dew-point to remove moisture and then must be reheated to desired temperature and humidity.)

H2.2.22 Avoid temperature stratification with heating, either by proper air supply system design or by using temperature destratifiers such as ceiling fans.

H2.2.23 In humid climates, supply air with a temperature above the dew point to prevent condensation on cold surfaces.

H2.2.24 Insulate fan-coil units and avoid their installation in unconditioned spaces.

H2.2.25 Clean heat exchangers (to *maintain* heat exchange efficiency) in the evaporators and condensers of refrigeration equipment on a seasonal basis.

H2.2.26 Use high-efficiency dehumidification systems based on either DOASs or VAV systems.

H2.2.27 Identify whether there are any rogue *zones* (i.e., *zones* that determine the cooling or heating demand on the entire system) in a multiple-*zone* air-handling system, and modify them to eliminate their negative impact.

H2.2.28 Modify supply duct systems to eliminate duct configurations that impose high friction losses on the system.

H2.2.29 Convert three-pipe heating/cooling distribution systems to four-pipe or two-pipe systems. Eliminate simultaneous heating and cooling through mixed returns.

H2.2.30 Convert steam or compressed air humidifiers to ultrasonic or high-pressure humidifiers.

H2.2.31 Replace mechanical dehumidification with desiccant systems using heat-recovery regeneration.

H2.2.32 Consider small unitary systems for small *zones* with long or continuous occupancy. Avoid running large distribution systems to meet needs of small, continuously occupied spaces.

H2.2.33 Install thermostatic control valves on uncontrolled or manually controlled radiators.

H2.2.34 Replace unitary systems with newer units with high efficiency and high SEER ratings.

H2.2.35 Install evaporative precooling for direct-expansion (DX) systems.

H2.2.36 Install air-side heat recovery for systems using 100% makeup air, such as run-around piping or energy exchange wheels.

H2.2.37 In reheat systems, make adjustments as necessary to minimize reheat energy consumption while maintaining indoor environmental quality.

H2.2.38 In multiple-*zone* systems, identify any rogue *zones* that consistently cause the reset of system-level set points in order to satisfy that one *zone*'s heating or cooling demands.

H2.3 Building Automation and Control Systems

H2.3.1 Create *building*/*conditioned space zones* with separate controls to suit solar exposure and occupancy.

H2.3.2 Use night setback, or turn off HVAC equipment when *building* is unoccupied.

H2.3.3 Install *occupancy sensors* with VAV systems; set back temperatures and shut off boxes.

H2.3.4 Install system controls to reduce cooling/heating of unoccupied space.

H2.3.5 Lower heating and raise cooling temperature set points to match the comfort range prescribed in ANSI/ASHRAE Standard 55 [N4].

H2.3.6 Install an air-side and/or water-side economizer cycle with enthalpy switchover when compatible with the existing equipment, space occupancy, and distribution system.

H2.3.7 Schedule off-hour meetings in a location that does not require HVAC in the entire facility.

H2.3.8 Retrofit multiple-*zone* VAV systems with *direct digital controls* (*DDC*) controllers at the *zone* level, and implement supply air duct pressure reset to reduce supply air duct pressure until at least one *zone* damper is nearly wide open.

H2.3.9 Eliminate duplicative *zone* controls such as multiple thermostats serving a single *zone* with independent controls.

H2.3.10 Adjust hot-water and chilled-water temperature to develop peak-shaving strategies based on an outdoor air temperature reset schedule.

H2.3.11 Adjust housekeeping schedule to minimize HVAC use.

H2.3.12 Install programmable *zone* thermostats with appropriate deadbands.

H2.3.13 Use VFDs and *DDC* on water circulation pump and fan motors and controls.

H2.3.14 Reduce operating hours of complementing heating and cooling systems. Ensure proper location of thermostat to provide balanced space conditioning.

H2.3.15 Implement an energy management system designed to optimize and adjust HVAC operations based on environmental conditions, changing uses, and timing.

H2.3.16 Install a fault detection and diagnostic (FDD) system and address identified faults. A FDD system should utilize *building* analytic algorithms to convert data provided by sensors and devices to automatically identify faults in *building* systems and provide a prioritized list of actionable resolutions to those faults based on cost or energy avoidance, comfort, and maintenance impact.

H3. REFRIGERATION

H3.1 Reduce Loads

H3.1.1 Install strip curtains or automatic fast open and close doors on refrigerated space doorways.

H3.1.2 Replace open refrigerated cases with reach-in refrigerated cases.

H3.1.3 Replace old refrigerated cases with new high-efficiency models (improved glazing, insulation, motor efficiency, and reduced antisweat requirements).

H3.1.4 Replace worn door gaskets.

H3.1.5 Replace broken or missing automatic door closers.

H3.1.6 Check defrost schedules and avoid excessive defrost.

H3.1.7 Repair/install refrigeration piping insulation on suction lines.

H3.1.8 Install humidity-responsive antisweat heating (ASH) controls on refrigerated case doors.

H3.1.9 Install refrigerated case, walk-in, or storage space lighting controls (scheduled and/or *occupancy sensors*).

H3.1.10 Install night covers to reduce infiltration in open cases.

H3.1.11 Install low/no ASH refrigerated case doors.

H3.1.12 Replace lights with LED strip lights with *motion sensors* in refrigerated cases and spaces.

H3.1.13 Increase insulation on walk-in boxes and storage spaces that have visible moisture or ice on walls, corners, etc. Ensure that insulation and vapor barrier are maintained or enhanced to ensure thermal *performance* and avoid water vapor intrusion.

H3.2 Improve System Operating Efficiency

H3.2.1 Clean condenser coils.

H3.2.2 Check the refrigerant charge and add when needed.

H3.2.3 Reclaim heat from hot-gas line for domestic water heating or space heating.

H3.2.4 Install floating-head pressure controls, adjustable-head pressure control valve, and balanced port expansion valves for DX systems.

H3.2.5 Install floating suction pressure controls on DX systems.

H3.2.6 Install evaporator fan motor VSDs and controllers in walk-ins and refrigerated storage spaces.

H3.2.7 Replace single-phase, <1 hp (746 W) evaporator fan motors with electrically commutated motors.

H3.2.8 Replace three-phase evaporator and condenser motors with premium efficiency motors.

H3.2.9 Replace single compressor systems with multiplex systems and control system.

H3.2.10 Install mechanical subcooling.

H3.2.11 Install mechanical unloaders on appropriate multiplex reciprocating semihermetic compressors.

H3.2.12 Install VFDs on ammonia screw compressors.

H3.2.13 Install high specific-efficiency condensers.

H3.2.14 Install hybrid air-cooled/evaporative-cooled condensers.

H4. WATER SYSTEMS

H4.1 Domestic Hot-Water Systems

H4.1.1 Lower domestic water set-point temperatures to 120°F (49°C).

H4.1.2 Install point-of-use gas or electric water heaters.

H4.1.3 Install water-heater blankets on water heaters.

H4.1.4 Where permitted by the manufacturer, and in conjunction with the manufacturer's control system, install automatic flue dampers on fuel-fired water heaters.

H4.1.5 Insulate hot-water pipes.

H4.1.6 Reclaim heat from waste water, refrigeration systems, cogeneration, or chillers.

H4.1.7 Install solar heating where applicable.

H4.1.8 Replace dishwashers by installing low-temperature systems that sanitize primarily through chemical agents rather than high water temperatures.

H4.1.9 Retrofit dishwashers by installing electric-eye or sensor systems in conveyor-type machines so that the presence of dishes moving along the conveyor activates the water flow.

H4.1.10 Reduce operating hours for water heating systems.

H4.1.11 Install gray-water heat recovery from showers, dishwashers, and washing machines.

H4.1.12 Install low-flow dishwashing prewash spray nozzles.

H4.1.13 Replace outdated laundry equipment with newer models.

H4.2 Water Conservation

H4.2.1 Replace faucets with units that have infrared sensors or automatic shutoff.

H4.2.2 Install water flow restrictors on shower heads and faucets.

H4.2.3 Install covers on swimming pools and tanks.

H4.2.4 Install devices to save hot water by pumping water in the distribution lines back to the water heater so that hot water is not wasted. Install industrial waste/sewage metering.

H4.2.5 Install water metering.

H4.2.6 Install landscape irrigation timers to schedule sprinkler use to off-peak, night, or early morning hours when water rates are cheaper and water used is less likely to evaporate.

H4.2.7 Use low-flow sprinkler heads for landscape irrigation instead of turf sprinklers in areas with plants, trees, and shrubs.

H4.2.8 Use sprinkler controls for landscape irrigation that employ soil tensiometers or electric moisture sensors to help determine when soil is dry and gage the amount of water needed.

H4.2.9 Use trickle or subsurface drip systems for landscape irrigation that provide water directly to turf roots, preventing water loss by evaporation and runoff.

H4.2.10 Install low-flow toilets and waterless urinals.

H4.2.11 Use water reclamation techniques.

H5. ENERGY GENERATION, DISTRIBUTION, AND MONITORING

H5.1 Boiler System

H5.1.1 Install air-atomizing and low NOx burners for oil-fired boiler.

H5.1.2 Investigate economics of adding insulation on presently insulated or uninsulated lines. If pipe or duct insulation is missing, replace it with new material. Ensure that the pipe insulation and vapor barrier are maintained or enhanced to ensure thermal *performance* and avoid water vapor intrusion.

H5.1.3 Review mechanical standby turbines presently left in idling mode.

H5.1.4 Review operation of steam systems used only for occasional services, such as winter-only tracing lines.

H5.1.5 Review pressure-level requirements of steam-driven mechanical equipment to consider using lower exhaust pressure levels.

H5.1.6 Survey condensate presently being discharged to waste drains for feasibility of reclaim or heat recovery.

H5.1.7 Reduce boiler operating pressure to minimize heat losses through leakage.

Note: These draft rules for the June 5, 2024 public meeting cover Chapters 1-6 only. Comments may be made at:
Comment on Chapters 1-3: https://odoe.powerappsportals.us/en-US/bps2/
Comment on Chapters 4-6: https://odoe.powerappsportals.us/en-US/bps-5-22-2024/

H5.2 Chiller System

H5.2.1 Chiller retrofits with equipment that has high efficiency at full and part load.

H5.2.2 Cooling-tower retrofits, including high-efficiency fill, VSD fans, fiberglass fans, hyperbolic stack extensions, fan controls, VSD pump drives, and improved distribution nozzles.

H5.2.3 Install economizer cooling systems (heat exchanger between cooling-tower loop and chilled-water loop before the chiller).

H5.2.4 Install evaporative cooled, evaporative precooled, or water-cooled condensers in place of air- cooled condensers.

H5.2.5 Isolate offline chillers and cooling towers.

H5.2.6 Reduce overpumping on chilled-water systems.

H5.2.7 Replace single compressor with multiple different-size staged compressors.

H5.2.8 Install two-speed, mechanical unloading, or VFD on compressor motors.

H5.2.9 Use an absorption chiller when there is cogeneration system, waste heat, or solar thermal available.

H5.2.10 Install double-bundle chillers for heat recovery.

H5.2.11 Free-cooling cycle by piping chilled water to condenser during cold weather.

H5.2.12 Prevent chilled water or condenser water flowing through the offline chiller. Chillers can be isolated by turning off pumps and closing valves.

H5.2.13 For equipment cooling, control makeup water and reduce blowdown by adding temperature control valves to cooling water discharge lines in equipment such as air compressors and refrigeration systems.

H5.2.14 For evaporative cooling systems, install drift eliminators or repair existing equipment.

H5.2.15 For evaporative cooling systems, install softeners for makeup water, side-stream filtration (including nanofiltration, a form of low-pressure reverse osmosis), and side-stream injection of ozone.

H5.2.16 For evaporative cooling systems, install submeters for makeup water and bleed-off water for equipment such as cooling towers that use large volumes of water.

H5.2.17 Evaporative cooling systems control cooling-tower bleed-off based on conductivity by allowing bleed-off within a high and narrow conductivity range. This will achieve high cycles of concentration in the cooling system and reduce water use in cooling towers.

H5.2.18 Clean evaporator and condenser surfaces of fouling.

H5.2.19 Optimize plant controls to raise evaporator temperature as high as possible while meeting system loads. Also optimize condenser water temperature control to achieve best combination of chiller and tower efficiency.

H5.2.20 Optimize multiple chiller sequencing.

H5.2.21 Control crankcase heaters off when they're not needed.

H5.2.22 Raise evaporator or lower condenser water temperature.

H5.2.23 Optimize multiple-chiller sequencing.

H5.2.24 Use two-speed or variable-speed fans instead of water bypass to modulate the cooling-tower capacity.

H5.2.25 Balance water flow in the chilled-water system.

H5.2.26 Use VFDs for the primary chilled-water pumps above 5 hp (3.7 kW). Consult chiller and tower manufacturers' specifications to set appropriate minimum flow limits.

H5.2.27 Apply cooling load-based optimization strategies.

H5.2.28 Install water-source heat pumps to augment the capacity of the hot-water boiler and to reduce the cooling load on the existing chiller systems when heat is required.

H5.2.29 Trim impellers on all condenser water and chilled-water pumps that are oversized.

H5.2.30 Replace all pump and fan motors with premium efficiency motors.

H5.3 Thermal Storage and Heat Pumps

H5.3.1 Install cool storage to reduce peak demand and lower electric bills.

H5.3.2 Install hot-water storage to shave peaks of hot-water use or to store reclaimed energy from combined heat and power (CHP) systems or waste heat from chillers for later use.

H5.3.3 Install add-on heat pumps.

H5.3.4 Install secondary pumping systems.

H5.3.5 Install VFDs on secondary pumps and replace most three-way valves with two-way valves.

H5.3.6 With cool storage and VFDs on fans and pumps, consider use of low-temperature chilled water to reduce fan and pump energy.

H5.3.7 Replace electrically powered air conditioning and heating units with heat pumps. Consider geo-thermal or ground-source heat pumps.

H5.3.8 Replace electric water heaters with electric heat-pump water heaters.

H5.4 Electric and Heat Cogeneration

H5.4.1 The application of cogeneration should be considered where use of both electrical and thermal energy can be achieved on a cost-effective basis.

H5.4.2 Subject to the approval of the *authority having jurisdiction*, where CHP plants are installed as energy efficiency improvements, the energy audit and analysis of overall *building* energy use *performance* may follow the Federal Energy Management Program (FEMP) guidelines, *Reporting Guidance for Federal Agency Annual Report on Energy Management* (per 42 U.S.C. 8258), Attachment 3 [N5]. Energy efficiency projects may be allowed to receive a credit in the amount of the annual *source energy* savings from CHP, which would be used to offset the *building site energy* used in calculating and comparing against the *EUI targets*.

H5.5 Energy System Monitoring

H5.5.1 Install a metering system to monitor the electrical energy use for each of the major electrical energy-using loads. These loads may include, but are not limited to, *HVAC systems*, water heating systems, cooking equipment, laundry equipment, interior lighting, exterior lighting, parking lots, parking ramps, elevators, escalators, and receptacle circuits.

H5.5.2 Install a metering system to monitor the fossil-fuel energy use for each of the major fossil-fuel energy-using loads. These loads may include, but are not limited to, space heating systems, water heating systems, pool heating systems, cooking equipment, clothes drying equipment, gas lighting, outdoor equipment, and all other miscellaneous fossil-fuel end-uses.

H6. NONRESIDENTIAL LIGHTING

In implementing any of these *EEMs*, care should be taken to not compromise the photometric distribution or any required light levels.

H6.1 General. Check the current Illuminating Engineering Society (IES) recommended light levels for the tasks in the facility. They may be lower than when the original lighting system was designed. Use these current recommended light levels to help shape all future lighting decisions, including those enumerated here. **H6.2 Daylighting**

H6.2.1 In any spaces with fenestration, evaluate opportunities for *daylight harvesting* by determining the spatial daylight autonomy (sDA) in accordance with IES LM-83 [N6]. In spaces where $sDA_{300,50\%}$ is greater than 55%, consider installing daylight switching or daylight dimming controls (and appropriate ballasts if the lighting system is fluorescent or high-intensity discharge [HID]) to reduce use of electric lighting.

H6.2.2 In any spaces with fenestration, evaluate the need for shading by determining the annual sunlight exposure (ASE) in accordance with IES LM-83 [N6]. In spaces where $ASE_{1000,250}$ is greater than 10%, interior and/or exterior shading should be installed to reduce solar heat gain and cut down on heat loss and control the amount of light entering the space from the exterior.

H6.2.3 Install a skylight, tubular daylighting device, or sunlight delivery system to reduce the use of electric lighting and provide natural daylight to the internal spaces of the *building*.

H6.3 Luminaire Upgrades

H6.3.1 Upgrade incandescent *lamps* in existing *luminaires* with more effective sources, such as halogen, integrally ballasted compact fluorescent, solid state (LED), or metal halide retrofit *lamps*. Alternatively, replace incandescent *luminaires* with *luminaires* using these sources.

H6.3.2 Upgrade T12 fluorescent *luminaires* with more effective sources, such as high-performance T8 or T5 systems, by replacing *lamps* and ballasts, using *luminaire* upgrade kits, or installing new *luminaires*.

H6.3.3 If the lighting system is already a high-performance fluorescent system, consider replacing the *lamps* with reduced-wattage *lamps* (where appropriate).

H6.3.4 For fluorescent lighting, install high-performance electronic ballasts that are multilevel or continuously dimmable with the appropriate controls.

H6.3.5 Replace mercury vapor or probe-start metal halide HID *luminaires* with pulse-start metal halide or high-performance T8 or T5 fluorescent *luminaires*.

H6.3.6 Upgrade task and display lighting, including lighting in refrigeration and freezer cases, to more effective sources, such as LED.

H6.4 Signage

H6.4.1 Evaluate upgrading standard fluorescent or neon signage with more effective sources, such as high-performance T8 or T5 fluorescent systems or solid-state (LED) systems.

H6.4.2 Upgrade all exit signs to solid state (LED). Supplemental lighting may need to be added if the existing exit sign also provides general lighting.

H6.5 Lighting Controls

H6.5.1 Reduce lighting use through management and controlled systems. In general, consider bringing the lighting control protocols for the *building* up to ASHRAE/IES Standard 90.1[N2], Section 9.4.1 requirements; this includes the following.

H6.5.2 Reduce operating hours for lighting systems through the use of controls and *building* management systems. This includes the use of shut-off controls, such as time switches.

H6.5.3 Use reduced lighting levels—including off—when spaces are unoccupied, during *nighttime hours*, and for restocking, cleaning, and security. Whenever possible move restocking and cleaning operations to normal operating hours.

H6.5.4 Use occupancy, vacancy, or *motion sensors*. Wherever applicable, these sensors should be manual-ON, or turn lighting on to no more than 50% of *lighting power*.

H6.5.5 Use controls to provide multiple light levels or dimming where appropriate.

H6.5.6 Recircuit or rezone lighting to allow personnel to only turn on *zones* based on use rather than operating the entire lighting system.

H6.5.7 Install personal lighting controls so individual occupants can vary the light levels within their spaces.

H6.5.8 Consider installation of lighting systems that facilitate load shed requests from the electric utility or energy aggregator.

H6.5.9 Evaluate turning emergency lighting off or to a lower level when a *building* or portion of a *building* is completely unoccupied, without sacrificing safety requirements.

H6.6 Exterior Lighting

H6.6.1 Use automatic controls that can reduce outdoor lighting levels or turn lights off when either sufficient daylight is available or when lighting is not needed. All facade and landscape lighting should be off from an hour after closing until an hour before opening. All other lighting should be reduced by at least 30% during that same time frame or when a *motion sensor* detects no activity for 15 minutes. These controls are not applicable to lighting for covered vehicle entrances or exits from *buildings* or parking structures where required for safety, security, or eye adaptation.

H6.6.2 Reduce power levels or turn exterior signage off when appropriate.

H6.6.2.1 Signs that are meant to be on for some part of *daylight hours* should be reduced in power by at least 65% during *nighttime hours*. All other sign lighting should automatically turn off during *daylight hours* and reduced in power by at least 30% from an hour after closing until an hour before opening. These controls are not applicable to sign lighting using metal halide, high-pressure sodium, induction, cold cathode, or neon *lamps* that are automatically reduced by at least 30% during *nighttime hours*.

H6.6.3 When selecting new outdoor *luminaires*, consider the amount of backlight, uplight, and glare delivered by each *luminaire* type to improve functionality and minimize environmental impacts. See ANSI/ASHRAE/ICC/USGBC/IES Standard 189.1 [N7], Section 5.3.6.

H6.7 Luminaire Layout

H6.7.1 Consider using lower levels of general illumination overall and then supplement with task lighting where needed.

H6.7.2 Consider new layouts that may maximize efficiency and reduce the total connected lighting load. Consider plug- and-play systems to provide flexibility as space use changes.

H6.8 Other

H6.8.1 Implement a plan to recycle *lamps*, ballasts, and *luminaires* removed from the *building*.

H6.8.2 Consider updating lighting systems to provide for demand response capability so that lighting loads are reduced during periods of peak electricity demand. These types of systems can provide day-to-day energy savings in addition to demand response capability.

H7. RESIDENTIAL LIGHTING

H7.1 General

H7.1.1 Replace incandescent *lamps* with halogen, integrally ballasted compact fluorescent, or solid-state (LED) retrofit *lamps* in existing *luminaires*.

H7.1.2 Color temperature indicates the color appearance of the light produced by the *lamp*. Halogen *lamps* are a more energy-efficient form of incandescent technology and will deliver light similar to incandescent *lamps*. Linear fluorescent, compact fluorescent, and solid-state (LED) *lamps* are available in a variety of color temperatures. *Lamps* with color temperatures of 2700 and 3000 K deliver the most incandescent-like light.

Lamps with a color temperature of 3500 K deliver a neutral, white light. *Lamps* with color temperatures of 4000 K and higher deliver cooler, white light; the higher the color temperature number, the cooler the light.

H7.1.3 Select *lamps* appropriate for use in enclosed *luminaires*, outdoor applications, and cold temperature applications, and for use with dimming controls. Check the packaging or manufacturer's website for guidance.

H7.1.4 Use energy-efficient technologies such as fluorescent, compact fluorescent, or solid state (LED) in applications with the longest operating times.

H7.1.5 Use a whole-home lighting control system that provides energy-saving features, such as dimming, occupancy sensing, and *daylight harvesting*, and allows occupants to turn all the lights off from a single location or remotely.

H7.2 Interior

H7.2.1 Replace on/off switches with dimming controls, vacancy sensors, or countdown timers. Use dimming controls, vacancy sensors, or countdown timers for lights or fans in bathrooms. Use vacancy sensors in garages, laundry rooms, closets, and utility rooms.

H7.2.2 Replace *lamps* and ballasts or install new *luminaires*. Ballasts should be FCC rated for residential use.

H7.2.3 Evaluate replacing incandescent and halogen *luminaires* with dedicated compact fluorescent or solid-state (LED) *luminaires*.

H7.2.4 When replacing fluorescent ballasts or installing new fluorescent *luminaires*, evaluate using electronic dimming ballasts with the appropriate dimming controls.

H7.2.5 Evaluate adding daylight-sensing controls for general illumination lighting in rooms with windows or skylights. Use in combination with dimming systems so that the electric light level can be adjusted based on the amount of daylight available.

H7.2.6 Install vacancy sensors to automatically turn off lighting in closets, storage, work rooms, garages, and exterior *buildings* when the space has been vacated for 15 minutes.

H7.2.7 Add task lighting that uses energy-efficient technologies, such as fluorescent and solid state (LED), and reduce or eliminate overhead lighting.

H7.3 Exterior

H7.3.1 Install time switches and/or *motion sensors* to control outdoor lighting.

H8. ELECTRIC SYSTEMS, MOTORS

H8.1 Install energy-efficient transformers. Use infrared cameras to identify high-heat-loss transformers.

H8.2 Reduce demand charges through load shedding, operational changes, and procedural changes.

H8.3 Replace oversized electric motors with right-sized or slightly oversized motors.

H8.4 Replace existing three-phase, 1 hp (746 W) and greater electric motors with premium-efficiency motors (often a better choice than rewinding motors).

H8.5 Replace existing one-phase, 1 hp (746 W) and less motors with electrically commutated motors.

H9. APPLIANCES

H9.1 Install appliances (clothes washers, dehumidifiers, dishwashers, freezers, refrigerators, room air cleaners and purifiers, office equipment, and televisions) that are certified as ENERGY STAR® compliant.

H9.2 Reduce plug loads, using devices to shut off equipment not being used (use *occupancy sensors* or timers).

H9.3 Install vending-machine controllers.

(This appendix is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

INFORMATIVE APPENDIX I
OPERATIONS AND MAINTENANCE REQUIREMENTS FOR BUILDING SYSTEMS AND ELEMENTS

I1. BUILDING ENVELOPE

I1.1 Operations and maintenance (O&M) requirements for the *building* envelope should include all applicable items in Section 6 plus the following.

I1.1.1 The *energy manager* (*EM*) should verify that a *building* envelope inspection is performed at least once every three years. Corrective action should be taken as needed, including addressing all of the following items.

I1.1.1.1 Seal all exterior joints in the *building* envelope, and all around penetrations of the *building* envelope by utility services.

I1.1.1.2 Replace broken or missing windows.

I1.1.1.3 Repair or replace exterior door weather stripping, threshold, and door sweeps as needed.

I1.1.1.4 Seal or cap obsolete shafts, chimneys, and other air chases.

I1.1.1.5 Repair or replace existing door closers on exterior doors.

I1.1.2 The *EM* should develop, document, and distribute procedures to *building* personnel for energy-efficient operation of exterior doors, loading docks, and operable windows.

I2. DOMESTIC HOT-WATER SYSTEMS

I2.1 General Requirements. O&M requirements for domestic hot-water (DHW) systems include all applicable items in Section 6 plus the following.

I2.1.1 Securely and visibly locate a list of operating parameters, such as temperature set points, pressures, and operating schedule, at each piece of equipment.

I2.2 Hot-Water Heaters

I2.2.1 *Maintain* proper combustion efficiency—carry out a combustion analysis and carbon monoxide testing at least annually, and make necessary corrections to achieve rated efficiency and safety.

Exception to I2.2.1 The input capacity of the heater is less than 100,000 Btu/h (29,310 W).

I2.2.2 De-energize booster heaters when the serviced equipment is not in use or is in standby mode. Make allowance for warm-up time in heater schedule.

I2.2.3 Control the DHW heater so that DHW temperature is maintained between 120°F (49°C) and 125°F (52°C).

Exceptions to I2.2.3:

1. Systems dedicated to serving equipment requiring higher water temperatures.
2. Systems that use a water heater to meet both domestic hot-water needs and space heating load.

I3. HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC) SYSTEMS

I3.1 Scope. The scope of Section D3 includes *HVAC systems* and components used to condition spaces within *buildings*. The O&M requirements for these systems and their components should minimize energy use over time while providing heating, ventilation, and cooling as needed for *building* operations and occupant needs. The O&M requirements for these systems should be evaluated when *building* use or other changes are made that affect system operations.

I3.2 General Requirements

I3.2.1 O&M requirements for *HVAC systems* include all applicable items in Section 6 plus the following.

I3.2.1.1 Each O&M task should be performed in a safe and professional manner by *qualified* personnel. Tasks that require specialized expertise should be performed by personnel with the requisite expertise who are certified where required by code or regulation.

I3.2.1.2 O&M tasks should be performed twice per year, unless otherwise noted in this standard, or as

recommended by the manufacturer.

I3.2.1.3 Securely and visibly display a list of operating parameters, such as temperature set points, pressures, and operating schedule, for each piece of equipment in the equipment room or the equipment location.

For equipment located in other areas, the list of operating parameters should be located in a readily accessible location close to the equipment, such as the unit control panel, or at the equipment access point, such as the roof hatch.

I3.2.1.4 For systems using refrigerant, *maintain* the refrigerant charge per the manufacturer's requirements.

I3.2.1.5 Display and *maintain* a *service log* on each piece of equipment as a visible and waterproof document.

I3.2.1.6 The *EM* and/or *building operator* should schedule, verify, and record O&M evaluations of the *HVAC systems*, taking corrective action where indicated. Such evaluations should include the following.

I3.2.1.6.1 Poll occupants and users of the *HVAC systems* for any observations or operational issues that have occurred.

I3.2.1.6.2 Physically inspect the maintained systems and components.

I3.2.1.6.3 Analyze occupant complaints and how these relate to system operation.

I3.2.1.6.4 *Maintain* indoor environmental quality parameters that have been established for the *building*, including temperature, humidity, and ventilation.

I3.2.1.6.5 *Maintain HVAC system* rooms and spaces for proper and safe service access. Relocate any material or debris impeding access to the HVAC equipment. *Maintain* service lighting.

I3.2.1.6.6 *Maintain HVAC system* schedules to meet current requirements, including the following.

I3.2.1.6.6.1 Occupied mode.

I3.2.1.6.6.2 Unoccupied mode, such as automatic shutdown, setup mode, setback mode.

I3.2.1.6.6.3 Start mode, such as warm-up mode, cool-down mode, optimum start mode.

I3.2.1.6.7 *Maintain HVAC system* electrical connections.

I3.2.1.6.8 *Maintain* equipment to avoid excessive mechanical noise and vibration.

I3.2.1.6.9 *Maintain* HVAC heat exchange surfaces for effective heat transfer.

I3.2.1.6.10 *Maintain* serviceable points of lubrication.

I3.2.1.6.11 Replace or clean filters in accordance with the manufacturer's recommended schedule or design pressure drop.

I3.2.1.6.12 *Maintain HVAC system* piping and duct systems against leakage.

I3.2.1.6.13 *Maintain* insulation on *HVAC system* piping and duct systems.

I3.2.1.6.14 *Maintain* the steam water heating, hot-water heating, and chilled-water cooling control valves against leakage a minimum of once every three years.

I3.2.1.7 Document periodic maintenance work and service work on *service logs*.

I3.3 Boiler Systems. The scope of this section covers the operation and maintenance of boilers, flues/vents, feed water equipment, piping, valves, steam traps, strainers, all fittings, and components comprising the entire system.

I3.3.1 O&M requirements for boiler systems include all applicable items in Section 6 plus the following.

I3.3.1.1 Boiler Burners

I3.3.1.1.1 *Maintain* proper combustion efficiency—carry out a combustion analysis and carbon monoxide testing at least annually, and make necessary corrections to achieve rated efficiency and safety.

I3.3.1.1.2 For boilers ≥400,000 Btu/h (117,240 W), design input, perform combustion analysis, and make adjustments to optimize boiler efficiency at least once annually.

I3.3.1.1.3 For boilers <400,000 Btu/h (117,240 W), design input, perform combustion analysis, and make adjustments to optimize boiler efficiency at least once every three years.

I3.3.1.1.4 *Maintain* burners.

I3.3.1.1.5 *Maintain* combustion chamber to avoid incomplete combustion.

I3.3.1.1.6 Inspect combustion chamber against cracks or deterioration.

I3.3.1.1.7 *Maintain* pilot and flame controls, flues, combustion air openings, and safeties.

I3.3.1.1.8 *Maintain* boiler blowdown to ensure it is functional and not excessive.

I3.3.2 Boiler Controls

I3.3.2.1 Adjust controls to cycle the boiler system through an entire heating cycle and *maintain* proper operation.

I3.3.2.2 *Maintain* reset controls.

I3.3.2.3 *Maintain* heating operations so they do not result in short or rapid cycling of the burners.

I3.3.3 Venting

I3.3.3.1 *Maintain* combustion and ventilation air openings.

I3.3.3.2 *Maintain* boiler vent discharge and intakes.

I3.3.4 Steam and Condensate Return Loop I3.3.4.1

Maintain condensate return systems. **I3.3.4.2**

Maintain feed water systems.

I3.3.4.3 *Maintain* pressure relief and venting.

I3.3.4.4 *Maintain* steam traps.

I3.3.4.5 *Maintain* water treatment.

I3.3.5 Hot-Water Hydronic Loop

I3.3.5.1 *Maintain* pump operation and sequencing.

I3.3.5.2 *Maintain* water systems makeup and relief.

I3.3.5.3 *Maintain* system water pressure.

I3.3.5.4 *Maintain* system free of leaks and entrained air.

I3.3.5.5 *Maintain* water treatment and antifreeze additives.

I3.4 Chilled-Water Systems. The scope of this section covers the operation and maintenance of chillers, condensers, open- and closed-type cooling towers, pumps, valves, strainers, piping, and all fittings and components that make up the system.

I3.4.1 Chillers

I3.4.1.1 *Maintain* refrigeration system for proper temperatures and pressures.

I3.4.2 Chilled-Water-System Controls

I3.4.2.1 *Maintain* controls to cycle the chilled-water system through an entire cooling cycle and verify proper operation.

I3.4.2.2 *Maintain* flow controls, operating controls, and safeties for proper operation.

I3.4.2.3 *Maintain* reset and head pressure controls for proper operation.

I3.4.2.4 Where cooling is provided by multiple units, *maintain* proper sequencing to achieve maximum efficiency while meeting required load.

I3.4.3 Chilled-Water Hydronic Loop

I3.4.3.1 *Maintain* proper water temperatures during operation.

I3.4.3.2 *Maintain* proper pump operation and sequencing.

I3.4.3.3 *Maintain* proper system water pressure.

I3.4.3.4 *Maintain* the entire system and ensure the distribution system is free of leaks and entrained air.

I3.4.3.5 *Maintain* water treatment.

I3.4.4 Cooling Towers and Condenser Water Loop

I3.4.4.1 *Maintain* proper water temperatures during operation.

I3.4.4.2 *Maintain* proper pump operation and sequencing.

I3.4.4.3 *Maintain* the entire system and ensure the distribution system is free of leaks and entrained air.

I3.4.4.4 *Maintain* water treatment, bleed control, and cycles of concentration.

I3.4.4.5 *Maintain* corrosion coupon consumption.

I3.4.4.6 *Maintain* cooling-tower sump.

I3.4.4.7 *Maintain* proper fan operation.

I3.5 Air-Side Heating, Cooling, and Ventilating Systems. The scope of this section covers the operation and maintenance of air-side heating, cooling, and ventilating systems ducting; terminal units; and components that make up the system.

I3.5.1 Air-Handling Systems

I3.5.1.1 *Maintain* all airflow components, including motors, fans, variable-frequency drives, inlet vanes, drain pans, piping, ductwork, dampers, louvers, coils, energy recovery devices, and cabinets, as applicable.

I3.5.1.2 *Maintain* controls, including sensors and actuators, and proper sequence of operation.

I3.5.1.3 *Maintain* heat exchange devices, including coils.

I3.5.1.4 *Maintain* damper systems.

I3.5.2 Heat Recovery Systems Including Energy Recovery Ventilation (ERV) and Heat Recovery Ventilation (HRV)

I3.5.2.1 See Section I3.5.1 as applicable.

I3.5.2.2 *Maintain* correct physical operation, such as wheel rotation, as applicable.

I3.5.3 Humidification

I3.5.3.1 *Maintain* fill and drain systems.

I3.5.3.2 *Maintain* water compartment for proper operation.

I3.5.3.3 *Maintain* sprayers and nozzles.

I3.5.3.4 *Maintain* sumps.

I3.5.3.5 *Maintain* control valve and steam traps.

I3.6 Perform heat exchanger testing on furnace heat exchangers at a minimum of once every three years per AHRI Guideline X, *Induced Draft Furnace Heat Exchanger Inspection* [N1].

I3.7 Review occupant hot/cold complaints and operator hot/cold observations. If the complaint is validated, do the following.

I3.7.1 Check the *HVAC system* equipment operation.

I3.7.2 Review draft problems.

I3.7.3 Review zoning conflicts.

I3.7.4 Test the *zone* for good and stable temperature control.

I3.7.5 Measure the humidity level to verify it is below the ASHRAE Standard 55 [8] upper dew-point limit of 62.2°F (16.8°C).

I3.7.6 Adjust diffusers and other parts of heating and cooling distribution systems to minimize overheating and overcooling of rooms and *zones*.

I3.8 *Maintain* economizer systems.

I3.8.1 Check that dampers move freely through their entire operating range. Clean, lubricate, adjust, and repair as necessary.

I3.8.2 *Maintain* damper blades and side seals.

I3.8.3 *Maintain* wiring.

I3.8.4 *Maintain* controls, including sensors, wiring, pneumatic tubing and their connections, damper actuators, damper linkages, and damper sequencing for proper operation.

I3.9 Unitary Systems and Air-Handling Systems I3.9.1

See Section I3.5.1 as applicable.

I3.9.2 *Maintain* system heating and cooling operation.

I3.9.3 *Maintain* controls for proper sequence of operations. **I3.9.4** *Maintain* condensate drain pan and piping.

I3.9.5 *Maintain* direct-expansion (DX) cooling or heating.

I3.9.6 Refer to Section I4 for DX refrigerant-based systems.

I3.10 Evaporative Cooling Systems

I3.10.1 See Section I3.5.1 as applicable.

I3.10.2 *Maintain* proper fill and drain operation.

I3.10.3 *Maintain* water compartment moisture and air containment.

I3.10.4 *Maintain* sprayers, nozzles, evaporative media, and water distribution components for proper operation.

I3.10.5 *Maintain* drains and clean sumps.

I3.10.6 *Maintain* proper system heating, heat recovery, and cooling operation.

I3.10.7 *Maintain* controls for proper sequence of operations.

I3.11 Geothermal Systems

I3.11.1 See Section I3.5.1 and I3.9 as applicable.

I3.11.2 *Maintain* system heating and cooling operation.

I3.12 Terminal Systems

I3.12.1 See D3.5.1 as applicable.

I3.12.2 *Maintain* system heating and cooling operation.

I3.13 Thermal Energy Storage Systems. The scope of this section covers thermal energy storage systems, ice-storage systems, phase-change storage systems, hot-water storage systems, and heat storage systems (e.g., using thermal mass).

I3.13.1 *Maintain* all equipment in accordance with requirements for each type of equipment elsewhere in this section.

I3.13.2 Operate the thermal energy storage system through its entire cooling and/or heating cycle and verify proper operation of all controls. Perform adjustments and repairs as necessary.

I4. REFRIGERATION SYSTEMS

I4.1 Scope. The scope of Section D4 includes the operation and maintenance of refrigeration systems and equipment that do not supply comfort cooling, such as display case refrigeration systems, refrigerated warehouses, and all medium- and low-temperature-product refrigeration systems.

I4.2 Operations and Maintenance. O&M requirements for refrigeration systems include all applicable items in Section I6.1 plus the following.

I4.2.1 Monitor refrigerating systems at regular intervals, determined by the type of system and historic leakage rates, to ensure that systems are well sealed, have the correct refrigerant charge, and are operating properly. Take the following actions as applicable.

I4.2.1.1 Securely and visibly locate a list of operating parameters, such as temperature set points, pressures, and operating schedule, at each piece of equipment.

I4.2.1.2 Check for refrigerant leaks using industry standard procedures.

I4.2.1.3 Monitor and record all additions of refrigerant to, or removals from, the system, along with the reason for the action.

I4.2.1.4 *Maintain* the refrigerant charge within the manufacturer's specified range.

I4.2.1.5 *Maintain* evaporator defrost system for proper operation.

I4.3 Retail Store Product Display Refrigeration Systems I4.3.1

Maintain refrigeration systems.

I4.3.2 The *EM* should work with staff to ensure they know correct product loading practices for display refrigerators. Avoid uneven loading, overloading, blocked air curtains, or blocked return air paths.

I4.3.3 In stores that are not open 24 hours a day, *maintain* the use of night covers for display cases and refrigerators to minimize ambient air infiltration.

I4.4 Walk-In Coolers and Freezers I4.4.1

Maintain refrigeration system.

I4.4.2 *Maintain* doors, including hinges, gaskets, and closures.

I4.4.3 *Maintain* evaporator and condenser coils.

I4.4.4 *Maintain* evaporator drains lines. In freezers, *maintain* the drain line heat tape to operate properly, and *maintain* the drain line insulation in good condition.

I4.4.5 *Maintain* the defrost operation, including frequency. Schedule defrost to avoid activation during peak demand periods.

I4.4.6 *Maintain* the interior of refrigerated enclosures for punctured or broken panels and breaches around pipe or wiring penetrations; *maintain* vapor barrier integrity.

I4.4.7 Encourage users to turn lights off when the room is vacant.

I4.5 Ice-Making Machines

I4.5.1 *Maintain* refrigeration systems.

I4.5.2 *Maintain* water system, reservoir, and evaporator coil for scale or mineral build-up and proper operation.

I4.5.3 *Maintain* strainer, inlet water valve screen, and float valve for proper operation.

I4.5.4 *Maintain* air filter, condenser coil, and condenser fan.

I4.5.5 *Maintain* the bin ice control for proper operation, including drain and water overflow.

I4.6 Refrigerated Warehouses

I4.6.1 *Maintain* refrigeration systems.

I4.6.2 The *EM* should work with users so that product is located to permit air circulation, particularly near walls and ceiling.

I4.6.3 Examine walls and ceiling monthly for evidence of frost build up. Locate the source and make corrective repairs.

I4.6.4 *Maintain* doors, rollers, door travel, and threshold as needed to minimize door leakage.

I4.6.5 *Maintain* the interior of refrigerated enclosures for punctured or broken panels and breaches around ducts, pipe, or wiring penetrations; *maintain* vapor barrier integrity.

I5. LIGHTING SYSTEMS

I5.1 The O&M program should include a lighting systems section. The lighting systems plan should include, as a minimum, the requirements listed in Section D5, which should be implemented at the time of compliance with this section and at three-year intervals thereafter.

I5.2 Lighting Controls. The *EM* should inventory and verify correct operation, programming, and placement of all lighting controls. Lighting controls that have been disabled should be repaired and made functional. Functional testing should be performed on *dimmers*, *multiscene controls*, *occupancy sensors*, time switches, or *photosensors*, if present, in accordance with the requirements of ANSI/ASHRAE/IES Standard 90.1 [N2], Section 9.4.4.

I5.3 Luminaire Integrity. The *EM* should survey all existing *luminaires* and create an as-built *lighting schedule*. This *lighting schedule* may be developed using a lighting survey tool. The *EM* should calculate and document the *lighting power density* and compare with any previous *lighting power density* calculation, such as those from original design documents or from previous *lighting schedules*. Continued compliance with this section requires that the *lighting power density* does not increase with time unless there is a corresponding, documented change in use of the space.

I5.4 The current *lighting schedule* should be evaluated for opportunities for energy savings through implementation of *energy efficiency measures* (*EEMs*), such as those listed in Informative Appendix H, Section H6 (nonresidential) or Section H7 (residential), and an estimate of the energy savings should be prepared. This estimate will be included in the energy management plan (see Section 5.1.2.13 if an energy management plan is required).

I5.5 Occupant Training

I5.6 Lighting Maintenance. The O&M program should specify the following.

I5.6.1 Replacement of failed *lamps* and ballasts.

I5.6.2 Replacement of failed *luminaires*.

I5.6.3 Periodic cleaning of all optical surfaces, including lenses, reflectors, louvers, and shielding mechanisms, as well as *lamps*. Individual luminaries should be cleaned whenever *lamps* or ballasts are replaced, and all luminaries as a group should be cleaned at least once every three years. All such cleaning should be performed in accordance with manufacturer's instructions if available.

I5.6.4 Any *lamp* or ballast replacement within the existing *luminaires* in a space should not increase the installed interior *lighting power density* of the space unless the previous light levels were less than the IES recommended levels as specified in the IES *Lighting Handbook* [4] or in the IES *Recommended Practices* title for that space type. If the exact space type cannot be found, then the space type with the closest functional activities should be used.

I5.6.5 For exterior residential lighting, all replacement *lamps* should be *high-efficacy lamps* unless controlled to automatically limit power use to less than 2200 total hours of full-power operation per year.

I5.6.6 For nonresidential exterior lighting, turn off all exterior lighting during *daylight hours*.

Exceptions to I5.6.6:

1. Signage.
2. Lighting needed for safety.
3. Lighting needed for operational necessity.

I5.7 Interior Lighting in Nonresidential Buildings. A lighting satisfaction survey should be conducted at least every three years and key issues identified and corrected as necessary.

I6. CONTROLS SYSTEMS

I6.1 Scope. The scope of Section D6 includes all types of control and energy management systems and components used to control *conditioned spaces* within *buildings*.

The O&M requirements for these systems and their components should minimize energy use over time while providing control of equipment and systems as needed for *building* operations and occupant needs. The O&M requirements for these systems should be re-evaluated when *building* use or other changes are made that negatively affect the systems' operations.

I6.2 All equipment should be maintained according to the manufacturer's instructions.

I6.2.1 Each O&M task should be performed safely and in accordance with good trade practice by *qualified* personnel. Tasks that require specialized expertise should be performed by personnel with the requisite expertise and who are appropriately certified where required by code or regulation.

I6.2.2 O&M tasks should be performed twice per year, unless otherwise noted in this standard, or as recommended by the manufacturer.

I6.2.3 The *EM* and/or *building operator* should schedule and perform evaluations of the control systems twice per year. System evaluations should include the following.

I6.2.3.1 Reviewing recorded trouble calls and occupant complaints and analyzing how these relate to control operation.

I6.2.3.2 Physically inspecting maintained systems and components.

I6.2.3.3 Checking that all set points are correct per efficiency requirements, design, or the owner's needs.

I6.2.3.4 Checking to ensure seasonal control changes are adjusted.

I6.2.3.5 Checking that time of day and holiday schedules are optimized to meet current occupied hours.

I6.2.3.6 Making calibration checks of all system-level sensors, including hot-water, chilled-water, and multiple-*zone* air-handling units, at least every three years.

I6.2.3.7 Making calibration checks of all space sensors showing small drift or offset over time at least once every five years.

I6.2.3.8 Checking whether controls are overridden or in manual operation and making corrections as necessary.

I6.2.3.9 Checking the control of minimum outdoor air ventilation and making adjustments where necessary to avoid either excessive or inadequate minimum outdoor airflows.

I6.2.4 Correct all issues found during the control system evaluations.

I6.3 Pneumatic Controls (including Pneumatic Sensors and Actuators)

I6.3.1 Check for properly operating receivers controllers and transducers and calibrate as required.

I6.3.2 Check for oil in the air lines and clean lines and any affected components as required.

I6.3.3 Check filters on air dryer and clean or replace as necessary.

I6.3.4 Check condenser coil on the air dryer and clean as necessary.

I6.3.5 Check pressure reducing valves (PRV or regulator) operation and calibrate as required.

I6.3.6 Check for leaks in air storage tank.

I6.3.7 Check tank condensate drain operation.

I6.3.8 Check thermostat for proper operation and calibrate as required.

I6.3.9 Check system for leaks in the high pressure lines.

I6.3.10 Check compressor run time; it should run less than 50% of the time. If runtime is excessive, check for leaks or other causes of high demand for control air and take corrective action as needed.

I6.3.11 Correct all issues found during the pneumatic control system evaluations.

I6.4 Analog Controls

I6.4.1 Check differential pressure gages operation.

I6.4.2 Check differential pressure switches operation.

I6.4.3 Check air pressure switches operations.

I6.4.4 Check thermostat operation.

I6.4.5 Check transformer input and output voltages.

I6.4.6 Check system's back-up batteries.

I6.4.7 Correct all issues found during the *analog control* system evaluations.

I6.5 Direct Digital Controls (DDC) (including Electronic Sensors and Actuators)

I6.5.1 Review *DDC* system applications programs and verify the system is working in accordance with the design sequence of operation.

I6.5.2 Confirm component readings are in range through audits, calibration, or comparison to *performance* standards.

I6.5.3 If the *DDC* system has back-up batteries, check system's back-up batteries.

I6.5.4 Inspect, clean, and *maintain* all sensors and meters in conformance with the manufacturer's recommendations.

I6.5.5 Verify the most recent calibration report of CO_2 sensors and recalibrate as recommended by the manufacturer.

I6.5.6 Check whether outdoor devices have adequate enclosures and whether the enclosures are in good conditions.

I6.5.7 Verify input and output transformer voltages.

I6.5.8 Verify control actuation, linkage attachment, stroke timing, and torque required for motor actuators.

I6.5.9 Correct all issues found during the *DDC* system evaluations.

Note: These draft rules for the June 5, 2024 public meeting cover Chapters 1-6 only. Comments may be made at:
Comment on Chapters 1-3: https://odoe.powerappsportals.us/en-US/bps2/
Comment on Chapters 4-6: https://odoe.powerappsportals.us/en-US/bps-5-22-2024/

I7. ELECTRIC POWER DISTRIBUTION AND ON-SITE GENERATION SYSTEMS

I7.1 Scope. The scope of Section D7 covers aspects of O&M for the *building* electrical power system that relate to the facility's energy efficiency.

I7.2 O&M requirements for electric power distribution and on-site generation systems include all applicable items in Section I6.1 plus the following.

I7.2.1 Each piece of on-site electrical generation equipment or built-up system should be maintained to the manufacturer's instructions.

I7.2.2 Metering and Submetering. Meters and submeters owned by the facility should be calibrated at least once every five years per the manufacturer's instructions.

I7.2.3 On-Site Electricity Generation

I7.2.3.1 Fuel-Fired Cogeneration. A monthly record of cogeneration operating hours and heat recovery should be maintained and reported annually. Annual energy generated and useful heat recovered should be compared to the design estimates for these values.

I7.2.3.2 Photovoltaic (PV) Systems. PV system *performance* should be reported on an annual basis. The annual output should be compared to the system's designed output or output during previous operating periods. Shortfalls in annual system *performance* should be analyzed for cause and possible system defects, and troubleshooting and corrective work should be performed as necessary.

I7.2.3.3 Fuel Cells. Fuel-cell *performance* should be reported on a monthly basis. Shortfalls in monthly system *performance* should be analyzed for cause and possible system defects, and troubleshooting and corrective work should be performed as necessary.

(This appendix is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

INFORMATIVE APPENDIX J
GUIDANCE FOR LOCALLY DERIVED BUILDING PERFORMANCE TARGETS

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.
b. **Limited Coverage of Uncommon Building Types.** Some *building* types, such as laboratories, courthouses, and enclosed malls have relatively few representatives. For example, those three *building* types have fewer than 50 samples in the Commercial Buildings Energy Consumption Survey (CBECS) 2012 data set [N12].
c. **Outdated Targets.** Due to the lag between CBECS and Residential Energy Consumption Survey (RECS) data [N13] collection and publication, as well as the time required for target analysis, the current targets are
based on energy *performance* data collected in 2012 (CBECS) and 2015 (RECS) and may not be representative of the current *building* stock in a specific climate *zone*.
d. **Limited Normalization Options.** Adjustment factors are only provided for operating hours and don't account for other productivity factors, such as number of occupants, meals, beds, tenant vacancies, etc.

As an alternative to using the default targets presented in this standard, *authorities having jurisdiction* (*AHJs*) have the option to use local data to determine their own targets. These locally derived *building performance targets* can be set to achieve specific energy or emissions reductions.

Section J2, "Goals, Metrics, and Targets," is a general overview of the concepts behind setting *performance targets* and is aimed towards policy makers. Section J3, "Data Collection/Generation" and Section J4, "Energy and Greenhouse Gas Emission Intensity Calculations," address data calculation and target development and are primarily targeted toward consultants or jurisdictions developing specific *performance targets*. While not discussed in this appendix, jurisdictions that are unable to use or collect local energy benchmarking data have several options for *building performance targets*. ASHRAE's *Building Performance Standards: A Technical Resource Guide* [N19] covers this topic in more detail. The first option is to use the default targets in Tables 7-2 through 7-6, which are based on national data sets, with the limitations listed in Section J2. The second option is using *building* energy modeling to characterize the *building* stock. The final option is to use a combination of partially applicable data sets (such as a national data set or one from a nearby region) and *building* energy modeling.

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:

Note: These draft rules for the June 5, 2024 public meeting cover Chapters 1-6 only. Comments may be made at:
Comment on Chapters 1-3: https://odoe.powerappsportals.us/en-US/bps2/
Comment on Chapters 4-6: https://odoe.powerappsportals.us/en-US/bps-5-22-2024/

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 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/ft^2/year [480 MJ/m^2/year] for office *buildings*)

J2.1 ANSI/ASHRAE/IES Standard 100 Default Targets vs. Locally Derived Targets. Locally derived targets are preferred when the *AHJ* has sufficient data on local *buildings*. When an *AHJ* has *building* energy data for an entire jurisdiction, creating locally derived targets is valuable, as the data set represents the actual population rather than a sample population. The more data a jurisdiction has on the *buildings* covered, the more accurately the effects of any given target can be predicted. When an *AHJ* has limited *building* energy data, such as data mostly from one climate region (but little from another) or data mostly from limited property types (but little from other property types), more care needs to be taken when developing local targets. Table J2-1 shows a comparison of national versus locally derived data sets.

If an *AHJ* has limited *building* energy data and wishes to create local targets, the *AHJ* should first obtain *building* energy data through a *building* energy benchmarking program that collects sufficient data to be representative of the *buildings* subject to this standard. Alternately, the *AHJ* can pursue other strategies to select targets, such as *building* energy modeling or the use of other data sets.

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 *building* types • Less accurate for local *buildings*
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 *building owners*/operators/occupants. • Data are accurately measurable by third parties and/or *building operators.*	• 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_2e/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 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 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.

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 *EUI*s to median values, total office *site energy* use will drop by 33%, and total K-12 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 $kBtu/ft^2/yr$

for offices and 27 kBtu/ft^2/yr for K-12 schools.

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

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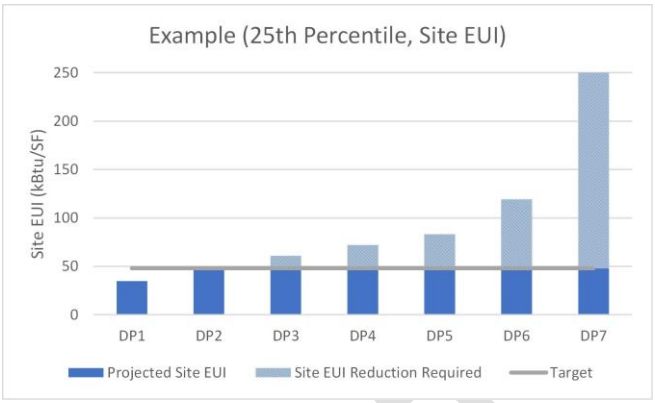
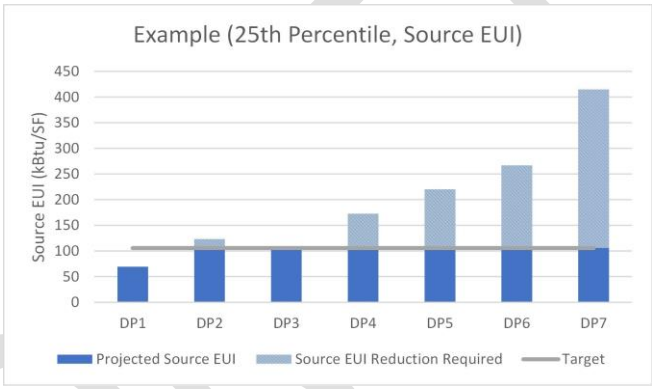
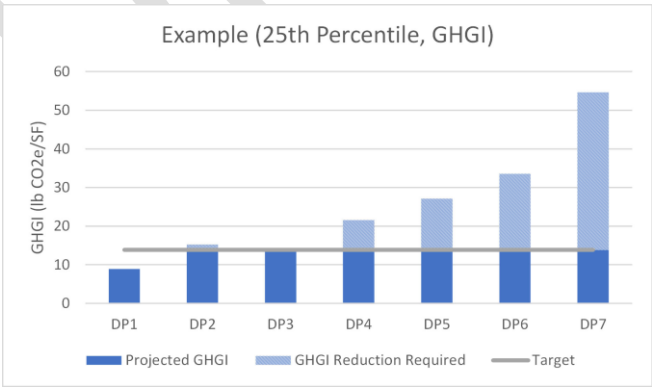


(a)



(b)



(c)

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

Table J2-5 Example: % EUI or GHGI Reduction Required to Meet 25th Percentile Targets

Property Type	Median EUI, kBtu/ft²/yr	% Energy Reduction from Meeting Median Site EUI	Target, kBtu/ft²/yr	% Energy Reduction from Meeting Target
Office	65	33%	44	50%
K-12 school	53	10%	27	50%

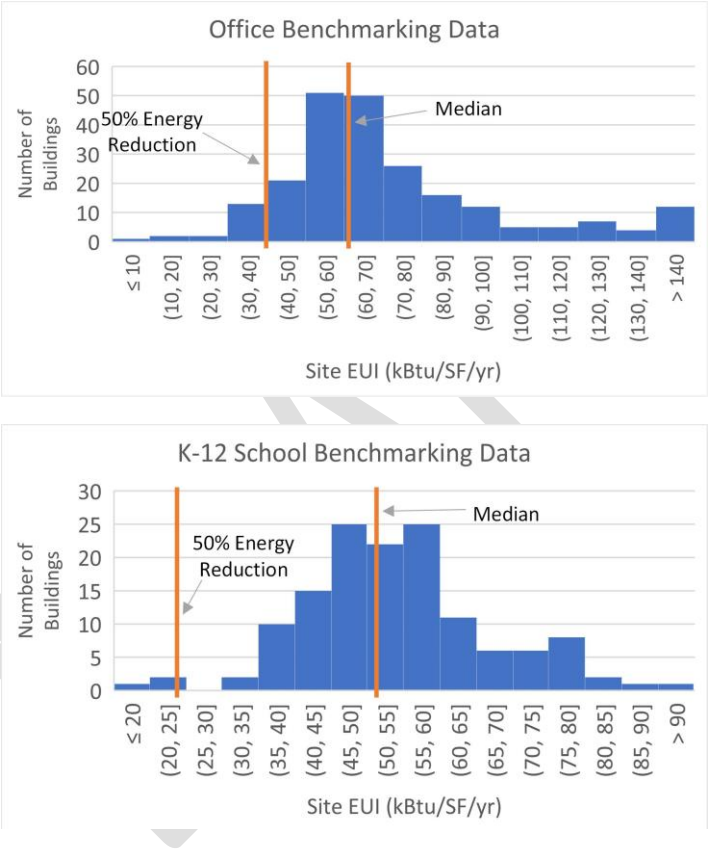


Figure J2-2 Example site EUI distributions for office and K-12 schools.

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).

The city decides to set two intermediate targets, one at 2030 and a second at 2035. The intermediate targets are set at equal intervals between the initial and final targets, shown in Figure J2-4.

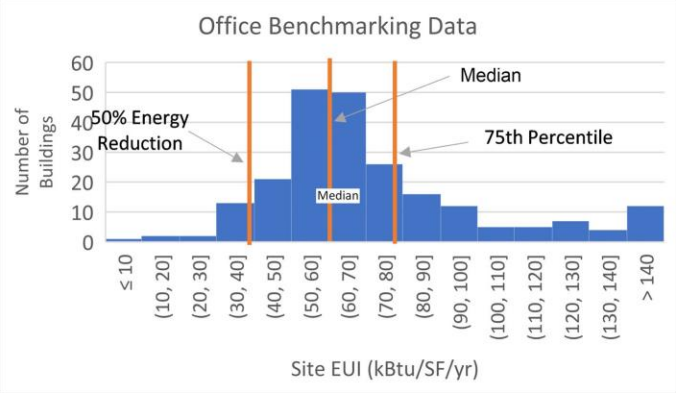


Figure J2-3 Example site EUI distribution—office buildings.

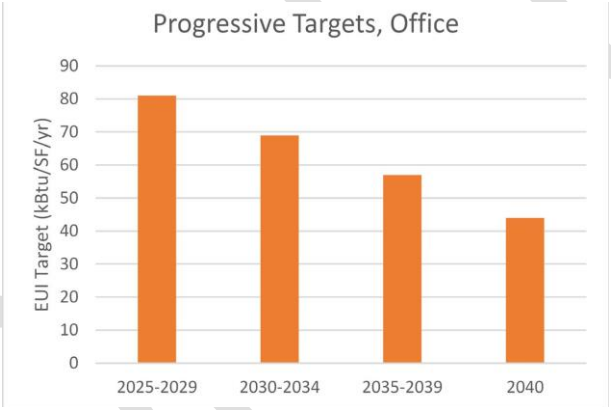


Figure J2-4 Example site EUI distribution—office buildings.

J3. DATA COLLECTION/GENERATION

Data used to develop local targets need to be collected and analyzed carefully. Local benchmarking data have several potential weaknesses: limited data on uncommon *building* types or normalization factors. Local data may also suffer from incorrect entry by users both for energy use values and *building* characteristics.

J3.1 Data Categorization and Normalization. Typical energy benchmarking ordinances require reporting *building* size, *EUI*, and other parameters of the *building* on an annual basis.

J3.1.1 Choosing Building Types. The first level of normalization of *performance targets* is dividing by *building* types, as different *building* types need energy for different purposes and therefore do not use energy in the same way. When choosing how to group *buildings* for setting *performance targets*, several factors should be considered:

a. The majority of *buildings* within a category should have relatively similar energy *performance*. A statistical analysis could be performed to determine if two populations are significantly different from each

other. Some *building* types may have too high of a variance of *EUI* due to different *building* productivity (for example, different computer, refrigeration, or ventilation requirements) to be set as a single group.

Table J3-1 Comparison of Individual Building vs. Campus or Complex Benchmarking Reporting

Reporting Resolution	Advantages	Disadvantages
Individual *building*	Simple to conceptualize; boundaries are drawn per-*building*, with some exceptions.	Owners may have difficulty establishing metering of all energy systems.
Campus/*complex*	Less work for portfolio owners; owners can implement district energy systems or other larger scale measures to meet goals.	Portfolio owners are allowed to have multiple *buildings* that would not meet targets by themselves, which may be perceived as unfair to other similar *buildings* not located on a campus.

b. When using representative samples of *buildings*, the grouping must have enough *buildings* to be appropriately representative of that population of *buildings*. If a jurisdiction has data on six fitness centers out of many (e.g., 100 or more) in the region for which it intends to establish a *building performance* standard, it cannot use a percentile-based method (refer to Section J3.2, "Data Verification/QA") to appropriately estimate how other fitness centers should perform. However, if all *buildings* in the population have been benchmarked, the data on those *buildings* fully characterize the population and can be used to determine targets to achieve specific energy or emissions reduction goals.

If a jurisdiction's benchmarking data are limited in scope (e.g., focuses only on specific *building* types or sizes, or on specific climate regions), special care must be taken to account for the lack of data. In some cases, the best solution may be to wait to collect energy benchmarking data for the *buildings* that lack data. In other cases, *building* energy modeling may be appropriate to account for differences between nationally and regionally available data sets.

When targets cannot be developed for a particular *building* or set of *buildings*, these *buildings* would follow the ANSI/ASHRAE/IES Standard 100 compliance process for *buildings* without targets.

One other consideration is whether to consider campuses or *complexes* of *buildings* with central energy plants as individual *buildings* or a campus (Table J3-1). Individual *buildings* within a campus may not be individually metered for district energy consumption or for other grid utility consumption. In this case, owners may want to meet their responsibilities via a portfolio of *buildings*, rather than on a *building*-by- *building* basis.

J3.1.2 Other Normalizations (Optional). Other normalizations can improve the specificity of *performance targets* but are not necessary to complete the locally derived *building performance* benchmarking process.

a. ASHRAE Climate Zones: Energy consumption and *performance* in *buildings* in "extremely hot-humid," "very hot-humid," "hot-humid," "hot-dry," "warm-humid," "warm-dry," "warm-marine," "mixed-dry," "mixed-humid," "mixed-marine," "cold-humid," "very cold," and "subarctic" zones will vary significantly. Grouping *buildings* by ASHRAE climate zone [N10] (see Figure E-1) will help normalize the data set with a measure that can be used for corresponding regions or locations. This only applies to jurisdictions whose covered *building* stock will span multiple climate *zones*.
b. Building Size: Classification of *buildings* by size will be helpful, as *buildings* of different sizes will require different levels of complexity. This metric could be the total gross floor area of the property, consistent with the ENERGY STAR® Portfolio Manager metrics. This measure will help mitigate negative effects from grouping *buildings* of all sizes together.
c. Operating Hours: The energy consumption for all *building* types will vary based on the annual operating hours. This measure will impact the total energy required or expected for heating and cooling the *building* and also impact the number of hours other equipment, such as lighting, will operate and consume energy.
d. Process-Specific Energy Uses: Other normalization factors are units of productivity of a *building*, particularly those that drive energy use trends, such as CT and MRI machines and ventilation rates in hospitals, conveyor systems in airports, cooking equipment in restaurants, commercial refrigeration systems in grocery stores, etc.

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 *EUI*s 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.

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 are also typically calculated from *site energy* multiplied by an emissions conversion factor.

J4.1 Site Energy Conversion Factors and Calculations. A *building performance* metric requires *site energy* measurements for all forms of energy used at a *building*. Some forms of energy, such as electricity and gas, are metered by energy distribution companies on a continuous basis. Other forms of energy, such as propane or fuel oil, may only be measured during the occasional refill at a *building* site. For many benchmarking programs, the goal is to obtain annual data. To ensure accurate comparisons against other *buildings* over the time period (e.g., January 1 to December 31), measured energy should be normalized. If the energy supplier does not provide *building*-specific energy use data on a timely basis, then the *building* will need to install its own energy metering equipment (sometimes called "submeters") to ensure proper, accurate, and timely measurements. Once annual data are collected, all forms of energy can be converted to kBtu (I-P) or MJ (SI) equivalents using the methodology found in Section 5.2 of this standard. Site *EUI* is calculated by dividing the energy use by the gross floor area (square feet [I-P] or square metres [SI]).

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:

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

where

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

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

Source Energy (I-P) = (100,000 kBtu/yr × 2.74) + (30,000 kBtu/yr × 1.09) = 306,700 kBtu/yr

Source Energy (SI) = (105,500 MJ/yr × 2.74) + (31,700 MJ/yr × 1.09) = 323,623 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_2e/kBtu	GHG Emissions Factor, kg CO_2e/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]).

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."

Before benchmarking, the *GHG emission* factors to be used should be established. The jurisdiction can choose national *GHG emission* factors; regional *GHG emission* factors, such as the U.S. regional *GHG emission* factors in ANSI/ASHRAE Standard 105 [N15], Table K3-A; or local *GHG emission* factors. Local *GHG emission* factors can be calculated for each energy form using the methodology in ANSI/ASHRAE Standard 105, Appendices J and K, or provided by the utility or other relevant agency.

GHG emissions are obtained by multiplying the *site energy* of each energy form by its corresponding *GHG emission* factor:

$$GHG\ Emissions = \sum_i E_{Site,\ Imported\ Energy\ Form\ i} \times GEF_{Imported\ Energy\ Form\ i}$$

where

$E_{Site,\ Imported\ Energy\ Form\ i}$ = *site energy* from imported energy form *i*
$GEF_{Imported\ Energy\ Form\ i}$ = *GHG emission* factor for imported energy form *i*

Example J4.3: A *building* has the energy use and *GHG emission* factors from ASHRAE Standard 105, Table K-3, shown in Table J4-2:

$$GHG\ Emissions = E_{Site,Grid\ Electricity} \times GEF_{Grid\ Electricity} \times E_{Site,Natural\ Gas} \times GEF_{Natural\ Gas}$$

GHG Emissions (I-P) =

$$\left(100{,}000\ \text{kBtu/yr} \times 0.326 \frac{\text{lb } CO_2e}{\text{kBtu}} + 30{,}000\ \text{kBtu/yr} \times 0.147 \frac{\text{lb } CO_2e}{\text{kBtu}}\right) = 37{,}010 \frac{\text{lb } CO_2e}{\text{yr}}$$

GHG Emissions (SI) =

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$$\left[105{,}500\ \text{MJ/yr} \times 0.140 \frac{\text{kg } CO_2e}{\text{MJ}}\right] + \left[31{,}700\ \text{MJ/yr} \times 0.063 \frac{\text{kg } CO_2e}{\text{MJ}}\right] = 16{,}767 \frac{\text{kg } CO_2}{\text{yr}}$$

The resulting *GHG emissions* are expressed in pounds (I-P) or kilograms (SI) carbon dioxide equivalent (CO_2e) per year. This process is described in greater detail in ASHRAE Standard 105. *GHG intensity* (*GHGI*) is calculated by dividing the *GHG emissions* by the gross floor area (square feet [I-P] or square metres [SI]).

Table J5-1 Selected Bases for Target Development

Basis for Target	Advantages	Disadvantages
Mean	Straightforward and easily understood	• Can be skewed by outliers. • Not always a good indicator of central tendency.
Percentile/median	• Median is not affected by outliers, potential better indication of central tendency. • Indicates the percent of *buildings* that are required to improve.	For small or irregular data sets, percentiles far from the median are difficult to determine with certainty.
Individual percentage improvement (i.e., all *buildings* must reduce individual use by X%)	• Allows for specific overall energy or emissions reduction goals. • Eliminates extreme reduction requirements for outlying *buildings* (this may be an advantage or disadvantage). • Methodology is easy to understand.	• Each *building* will have its own target, which can be difficult to communicate or track. • High-performing *buildings* will still have to lower their energy use; may be perceived as punishing those that have already pursued major energy-efficiency upgrades.
Overall percentage improvement (i.e., set target at specific *EUI* to achieve X% overall reduction)	Allows for specific overall energy or emissions reduction goals.	• Deriving targets is more complex. • Does not indicate the number of *buildings* that are required to improve.
Zero GHG emissions	Aligns with long-term climate goals.	Requires significant changes in existing *buildings*. Should be paired with interim targets to ensure *buildings* make appropriate progress over time.
Targets requiring *building* simulation modeling	Can be used when data are unavailable or incomplete.	• Requires more effort to characterize *building* stock. • Simulated data quality is limited by the input data and simulation depth/ methodology.

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.

J5.1 Getting Started

J5.1.1 Exploratory Data Analysis. When deciding on how stringent to set target levels, it is helpful to first perform an exploratory data analysis to determine the distribution of *EUI*/*GHGI* among *buildings* within each category. If there are *EUI*/*GHGI* ranges where a majority of *buildings* perform, it may be relatively feasible to achieve that *performance* for the higher *EUI*/*GHGI buildings*. A large spread of *EUI*/*GHGI* or two distinct peaks in the distribution may indicate that these properties have more inherent variability in *performance* or should be divided into more specific categories. The shape of the *EUI*/*GHGI* distribution may differ between *building* types, and understanding these distributions may help prioritize how stringently to set targets for each *building* type to achieve overall *performance* goals.

Refer to the example in Section J2.3 (particularly Figure J2-2, "Example site *EUI* distributions for office and K-12 schools"), which shows an office *building EUI* distribution that has many outliers to the right. This distribution shape results in much greater energy savings potential for the office *buildings* compared to the K-12 school *buildings* when setting targets at the median rather than the K-12 school *buildings*. With targets set to achieve 50% overall *EUI* reduction, the median office *building* must reduce its *EUI* by 32%, while the median K-12 school *building* must reduce its energy use by 49%.

In this scenario, the *AHJ* may choose to set targets to some percentage below the median for both property types. To achieve 50% overall *EUI* reduction, targets could be set at 29% below the median for both office and K-12 school property types.

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

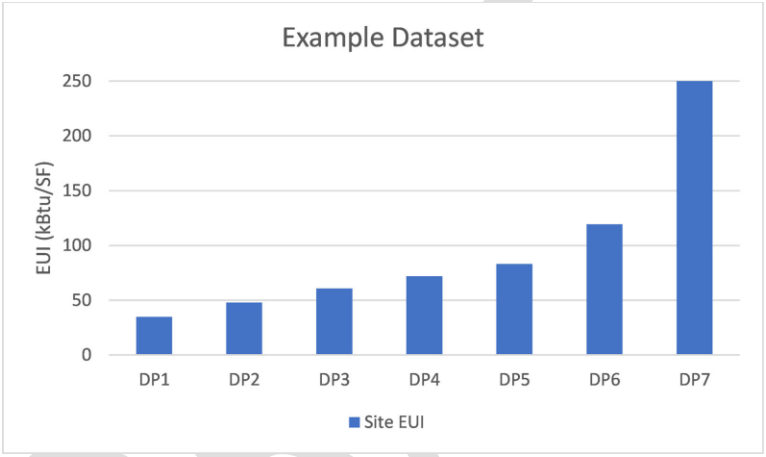

Figure J5-1 Example data set.

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:

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

$$\text{Projected Energy/Emissions} = \sum_i \min(T, P_i) \cdot FA_i$$

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*)

Finally, find the percent improvement in energy or emissions using the *baseline* and project values:

$$\text{Project Percent Improvement} = 100\% - \frac{\text{Projected Energy/Emissions}}{\textit{Baseline}\ \text{Energy/Emissions}} = 100\% - \frac{\sum_i \min(T, P_i) \cdot SF_i}{\sum_i DP_i \cdot SF_i}$$

J5.2 Mean-Based Targets. Set the target at the mean *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.

Table J5-3 Example: Impact of Mean-Based Target

Building	Site EUI, kBtu/ft²/yr	Site EUI Reduction Required, kBtu/ft²/ yr	% EUI Reduction Required
DP1	35	0	0%
DP2	48	0	0%
DP3	61	0	0%
DP4	72	0	0%
DP5	83	0	0%
DP6	119	24	20%
DP7	250	155	62%

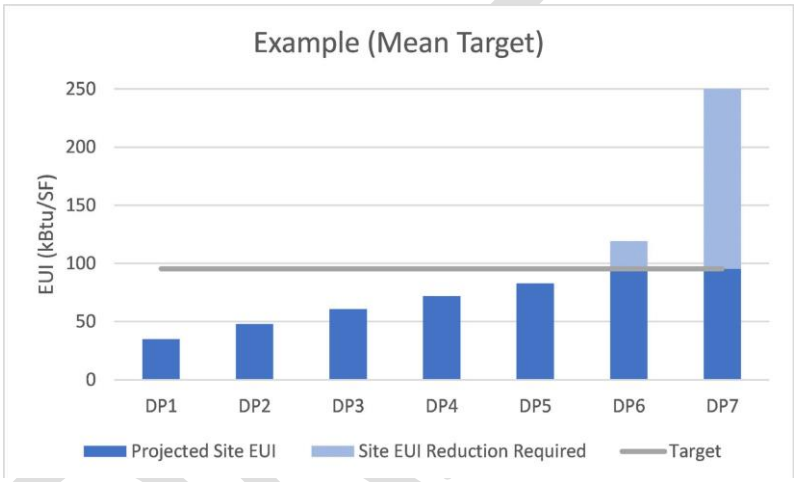

Figure J5-2 Example: Impact of mean-based target.

The mean *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%.

J5.3 Percentile/Median-Based Targets. Define a desired percentile, *P*, (e.g., 25th percentile, which is the base requirement in this standard) of the existing *building* stock to represent the minimum *performance* standard to which all existing *buildings* shall reduce energy use or emissions. For each *building* category, sort data points by their value from lowest to highest. Set the target equal to the data point that corresponds to the desired percentile of the data set. There are multiple methodologies for computing a percentile value, so it is recommended to use your mathematical platform of choice to determine the percentile.

Example J5.3a: Consider the previous data set to determine a target based on the 25th percentile. For a data set with *n* data points and a desired percentile of *P*, the target will be the data point at position
$P \div 100 \times n$, where $P \div 100 \times n$ is rounded to the nearest integer.

The 25th percentile data point at position $P \div 100 \times n$ = ($25 \div 100 \times 7$) = 1.75 ≈ 2. Choose DP_2 (48 kBtu/ft²/yr) as the target. Setting the target at the 25th percentile, 48 kBtu/ft²/yr, results in 50%

projected percent improvement (Table J5-4).

Example J5.3b: Consider the previous data set to determine a median-based target. Setting the target at the median (72 kBtu/ft^2/yr) results in 33% projected percent improvement (Table J5-5).

Table J5-4 Example: Impact of 25th Percentile-Based Target

Building	Site EUI, kBtu/ft²/yr	Site EUI Reduction Required, kBtu/ft²/yr	% EUI Reduction Required
DP1	35	0	0%
DP2	48	0	0%
DP3	61	13	21%
DP4	72	24	33%
DP5	83	35	42%
DP6	119	71	60%
DP7	250	202	81%

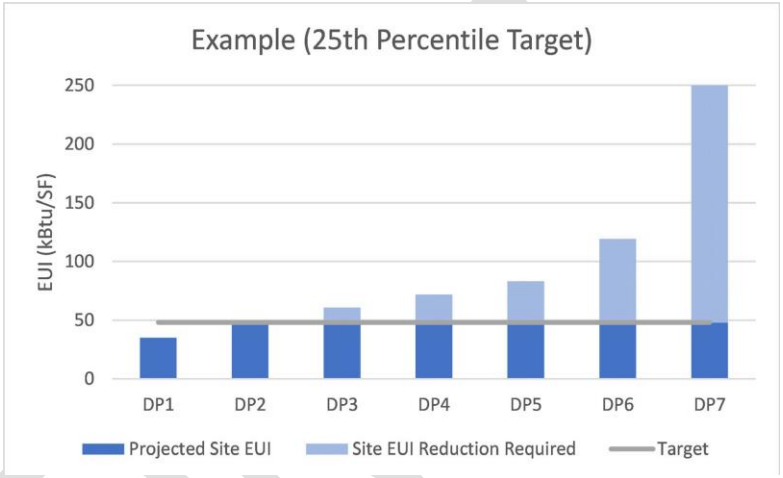

Figure J5-3 Example: Impact of 25th percentile-based target.

J5.4 Individual Percent Improvement Targets. Instead of setting a specific *EUI* or *GHGI* target, instead define a desired percent improvement (e.g., 40%) to which all existing *buildings* shall reduce energy use or emissions. Each *building* will have its own target based on its own *performance* metric.

Example J5.4: Consider the previous data set. To establish a 40% individual percent improvement target, each *building* sets its target at 40% less than the *baseline* amount (Table J5-6). This methodology results in 40% project percent improvement.

J5.5 Overall Percent Improvement Targets. Define a desired percent energy use or emissions improvement target, *P*, (e.g., 40%) to be achieved across the *building* stock through energy use or emissions reductions by all *buildings* performing worse than the overall percent improvement target calculated below.

For each *building* category, sort all data points in the data set by value from lowest to highest. For each data point in the sorted data set, calculate a corresponding value, P_i, representing the hypothetical percent improvement in *building* stock energy use or emissions if the data point were set as the target:

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

where

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$\sum_i DP_i \cdot SF_i$

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

Table J5-5 Example: Impact of Median-Based Target

Building	Site EUI, kBtu/ft²/yr	Site EUI Reduction Required, kBtu/ft²/yr	% EUI Reduction Required
DP1	35	0	0%
DP2	48	0	0%
DP3	61	0	0%
DP4	72	0	0%
DP5	83	11	13%
DP6	119	47	40%
DP7	250	178	71%

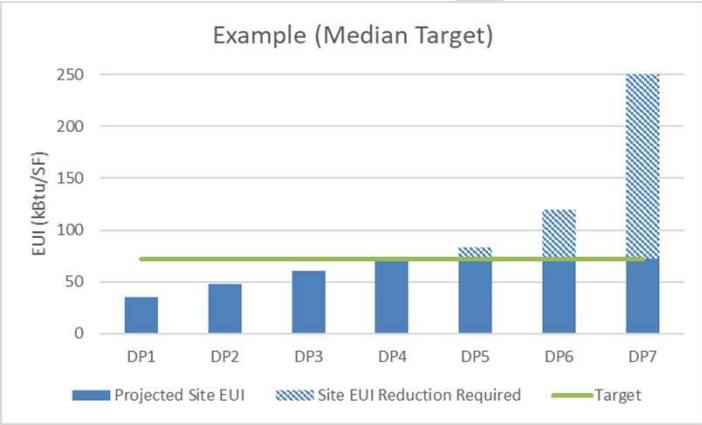

Figure J5-4 Example: Impact of median-based target.

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

Match the desired percent improvement target, P_{spi}, to the closest P_i value and calculate the overall percent improvement target, T_{spi}, as follows:

$$\text{Overall Percent Improvement Target} = T_{spi} = DP_t$$

where

t = index of the data point corresponding to the P_i value closest to the desired percent improvement,
P_{spi} DP_x = data point corresponding to the *x* lowest value in the *building* category's data set

Converting the percent improvement target to an equivalent percentile helps contextualize the target. Calculate the equivalent percentile as follows:

$$\text{Equivalent Percentile} = \frac{t}{n} \times 100$$

where

t = index of the data point corresponding to the P_i value closest to the desired percent improvement,
P_{spi} n = total number of data points in the *building* category's data set

Table J5-6 Example: Impact of 40% Individual Percent Improvement

Building	Site EUI, kBtu/ft²/yr	Site EUI Reduction Required, kBtu/ft²/yr	% EUI Reduction Required
DP1	35	14	40%
DP2	48	19	40%
DP3	61	24	40%
DP4	72	29	40%
DP5	83	33	40%
DP6	119	48	40%
DP7	250	100	40%

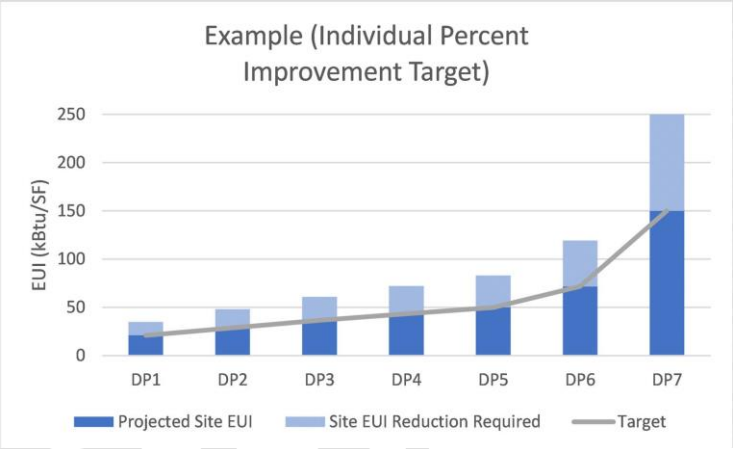

Figure J5-5 Example: Impact of 40% individual percent improvement.

Example J5.5: Consider the previous data set. For each data point, the projected percent improvement is calculated as if that data point were the target, shown in Table J5-7.

If the jurisdiction's goal is 40% overall savings, setting the target at DP_3, or 61 kBtu/ft²/yr, will nearly reach that goal. To reach 40%, the jurisdiction decides to set the target to 60 kBtu/ft²/yr (Table J5-8).

J5.6 Zero Greenhouse Gas Emissions Targets. A jurisdiction may choose to set a target to zero to correspond to a zero-emission goal. While the target development on this is easy, it is often paired with multiple interim targets, which can be based on any of the methods described previously.

J5.7 Targets Requiring Building Simulation Modeling. Where *building*-type data sets lack sufficient sample quality or sample quantity for each climate *zone* represented in the jurisdiction despite benchmarking efforts, *building* simulation modeling can be utilized to extrapolate targets from one climate *zone* to another. Calibrated *building* simulation models can be constructed to generate annual *EUI*s equal to targets developed from data sets with sufficient sample quality and sample quantity. The calibrated *building* simulation models can be adjusted and simulated using weather data from different climate zones to determine targets for data sets lacking sufficient sample quality or sample quantity. *Building* simulation modeling could also be utilized to extrapolate targets from one *building* type to another, although the resulting targets will be less representative of the *building* stock given more significant discrepancies in design and construction standards across *building* types compared to climate zones.

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Modeling a representative *building* for each *building* type requires extensive knowledge of the *building* stock and what programs, forms, construction types, internal loads, occupancies, and *HVAC system* types are

Table J5-7 Example: Overall Percent Improvement for Targets Set at Each Data Point

Building	Site EUI, kBtu/ft²/yr	Overall Percent Improvement if This Data Point Was Set to the Target
DP1	35	62%
DP2	48	50%
DP3	61	39%
DP4	72	33%
DP5	83	28%
DP6	119	18%
DP7	250	0%

Table J5-8 Example: Impact of 40% Overall Percent Improvement

Building	Site EUI, kBtu/ft²/yr	Site EUI Reduction Required, kBtu/ft²/yr	% EUI Reduction Required
DP1	35	0	0%
DP2	48	0	0%
DP3	61	1	1%
DP4	72	12	17%
DP5	83	23	28%
DP6	119	59	50%
DP7	250	190	76%

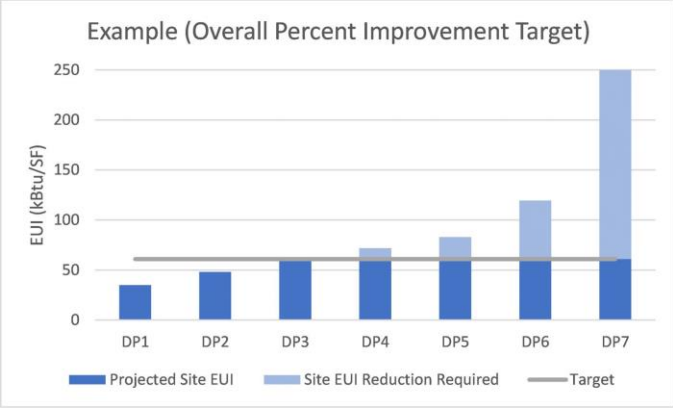

Figure J5-6 Example: Impact of 40% overall percent improvement.

typical for each *building* type. Calibrating the simulation models to equate annual *EUIs* and fuel mixes with the targets also requires extensive knowledge of the simulation engine and how model components should be adjusted to maintain sufficient validity. Implementing benchmarking programs is the suggested path to develop a comprehensive set of targets. Should *building* simulation be necessary, refer to Duer-Balkind et al. [N20] and Informative Appendix F.

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

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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

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Table J6-1 Median Site EUI and Percentiles for Hospitals (Energy Use in 2022 Calendar Year)

Building America Climate Zone	Median Site EUI	25th Percentile Site EUI[a]	40th Percentile Site EUI[a]	60th Percentile Site EUI[a]	75th Percentile Site EUI[a]
Hot-humid	232	174	217	246	269
Hot-dry	235	194	211	244	270
Marine	210	185	202	223	238
Mixed-dry[b]	—	—	—	—	—
Mixed-humid	242	207	229	255	276
Cold	230	198	217	241	268
Very cold	253	—	—	—	—
Overall	234	198	219	246	270

a. Percentiles are withheld from "Very cold" climate zone (fewer than 30 hospitals).
b. Insufficient data are available for hospitals in "Mixed-dry" climate zone.

Table J6-2 Hospital Size Categories Used in ASHE 2023 Energy Benchmarking Study

Size Category	Number of Beds	Typical Gross Square Footage
Critical access hospital (CAH)	≤25	<50,000
Small	26 to 99	50,000 to 250,000
Medium	100 to 399	250,000 to 825,000
Large	≥400	>825,000

Table J6-3 Adjusted Median Site EUI and Percentiles for Small Hospitals (Using a Factor of 1.05)[c]

Building America Climate Zone	Median Site EUI	25th Percentile Site EUI[a]	40th Percentile Site EUI[a]	60th Percentile Site EUI[a]	75th Percentile Site EUI[a]
Hot-humid	243	183	227	258	282
Hot-dry	246	203	222	257	283
Marine	220	195	212	235	250
Mixed-dry[b]	—	—	—	—	—
Mixed-humid	254	218	241	268	290
Cold	241	208	228	254	281
Very cold	265	—	—	—	—
Overall	246	208	230	258	283

a. Percentiles are withheld from "Very cold" climate zone (fewer than 30 hospitals).
b. Insufficient data are available for hospitals in "Mixed-dry" climate zone.
c. The values in this table apply to small hospitals only and are calculated by multiplying the values for all hospitals by a factor of 1.05.

develop the *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.

The 25th percentile targets shown in Table J6-1 are comparable to the default targets in Table 7-2 and could be used for the "Hospital/Inpatient Health" targets in Table 7-2. The median site *EUI* values are

comparable to the values in Table G-3. For small hospitals, Table J6-3 shows adjusted median site *EUI* values and percentiles for facilities less than 250,000 ft^2 (25,000 m^2).

Note: The ASHE data points are for inpatient hospitals (general medical and surgical), not for longterm care or rehabilitation hospitals.

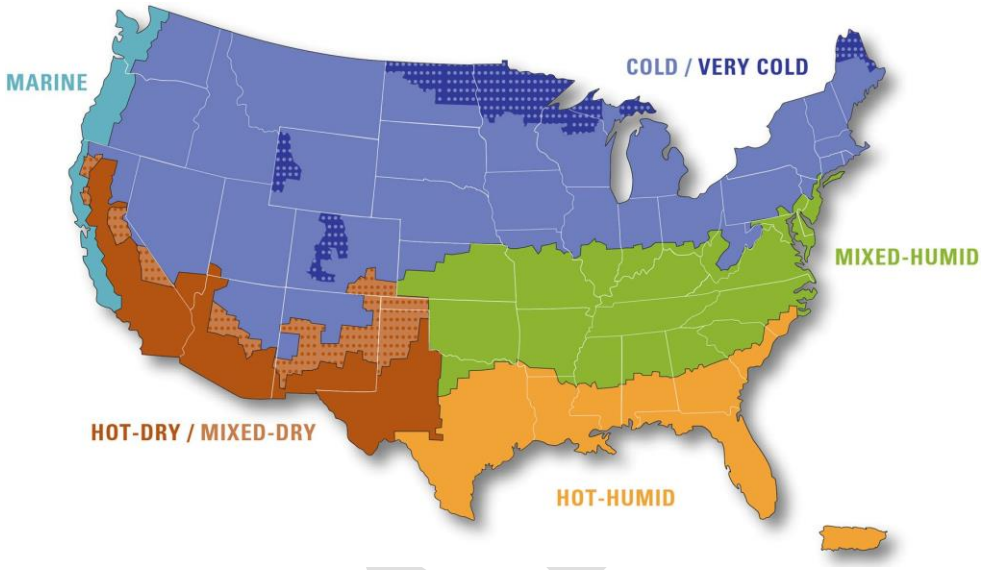

Figure J6-1 Example: Impact of median-based target.

J6.1 Climate Zones. The ASHE 2023 analysis used Building America climate zones (7 zones for the United States) vs. the IECC 2021 climate zones (21 zones for the United States); refer to Table J6-1 and Figure J6-1. There are fewer Building America climate zones, resulting in stronger statistical results while still accounting for variations in climate and moisture regimes.

J6.2 Limitations. The 2022 calendar year values are the most recent and are most reflective of current operations (2020 and 2021 saw changes that may have been affected by hospitals' response to COVID). However, there are an insufficient number of hospitals in the Building America "Mixed-Dry" climate zone to present meaningful median and percentile figures, and the "Very Cold" climate zone has less than 30 facilities providing energy data; therefore, only the median site *EUI* is presented.

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 *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.

J6.3.1 Size Factor. A size factor of 1.05 should be applied to the site *EUI* for small hospitals, recognizing that these facilities have a higher *EUI* than medium and large hospitals.

Applying this factor to the median site *EUI* and percentiles results in the targets for small hospitals shown in Table J6-3.

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.

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INFORMATIVE APPENDIX K
FUEL HEAT CONTENT CONVERSION VALUES—"OTHER" FUELS

ANSI/ASHRAE Standard 105 [N15], Table G-1, has been reproduced here as Table K-1 and can be used to determine the heating value of fuels other than those listed in Table 5-1 of this standard.

Table K-1 Higher Heating Values

Coals		**Btu/lb**		**kWh/kg**	
Anthracite		12,700		8.2	
Semianthracite		13,600		8.8	
Low-volatile bituminous		14,350		9.3	
Medium-volatile bituminous		14,000		9.0	
High-volatile bituminous A		13,800		8.9	
High-volatile bituminous B		12,500		8.1	
High-volatile bituminous C		11,000		7.1	
Subbituminous B		9000		5.8	
Subbituminous C		8500		5.5	
Fuel Oils		**Btu/U.S. gal [a]**		**kWh/L [a]**	
#1 (Kerosene)		See Table 5-1		See Table 5-1	
#2		See Table 5-1		See Table 5-1	
#4		See Table 5-1		See Table 5-1	
#5L		148,000		11.5	
#5H		150,000		11.6	
#6		See Table 5-1		See Table 5-1	
Gas	Natural gas	See Table 5-1		See Table 5-1	
	Propane	See Table 5-1		See Table 5-1	
Bagasse (Moisture Free)		8900 Btu/lb		5.8 kWh/kg	
Sawdust, Peat, Bark		9000 Btu/lb		5.8 kWh/kg	
Woods		**Mass lb/cord [b], kg/m^3**		**Million Btu/Cord [b], kWh/m^3**	
Species		**Green [c]**	**Air-Dry [d]**	**Green [c]**	**Air-Dry [d]**
Ash		3840 (480)	3440 (430)	16.5 (1300)	20.0 (1600)
Aspen		3440 (430)	2160 (270)	10.3 (800)	12.5 (1000)
Beech, American		4320 (540)	3760 (470)	17.3 (1400)	21.8 (1800)
Birch, yellow		4500 (560)	3680 (460)	17.3 (1400)	21.3 (1700)
Douglas fir		3200 (400)	2400 (300)	13.0 (1100)	18.0 (1500)
Elm, American		4320 (540)	2900 (360)	14.3 (1200)	17.2 (1400)
Hickory, shagbark		5040 (630)	4240 (530)	20.7 (1700)	24.6 (2000)
Maple, red		4000 (500)	3200 (400)	15.0 (1200)	18.6 (1500)
Maple, sugar		4480 (560)	3680 (460)	18.4 (1500)	21.3 (1700)
Oak, red		5120 (640)	3680 (460)	17.9 (1400)	21.3 (1700)
Oak, white		5040 (630)	3920 (490)	19.2 (1600)	22.7 (1800)
Pine, eastern white		2880 (360)	2080 (260)	12.1 (1000)	13.3 (1100)
Pine, eastern yellow		4000 (500)	2600 (330)	14.2 (1100)	20.5 (1700)

a. "Table 5-1" in this column refers to Standard 105.
b. Based on 80 ft^3 of solid wood stacked in a 128 ft^3 cord, for a void fraction of 37.5%. Cubic metres apply to the gross volume of a stacked pile of wood with this void fraction.
c. 40% to 60% moisture
d. 20% moisture

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INFORMATIVE APPENDIX L
SIMPLE PAYBACK AND LIFE-CYCLE COST ANALYSIS

L1. SIMPLE PAYBACK AND LIFE-CYCLE COST ANALYSIS

L1.1 General. For small *buildings* and efficiency improvement measures with a payback period of fewer than five years, *simple payback* is probably adequate to make decisions. For federal *buildings*, larger *buildings*, or *buildings* with longer payback periods, more sophisticated financial analyses are advisable.

Life-cycle costing (LCC) is used to evaluate the total cost of ownership of *energy efficiency measures* (*EEMs*). LCC accounts for factors such as the time value of money, escalation of *energy costs* over time, annual maintenance costs, component replacement costs, and the useful life of the equipment. Other factors that may also be considered include temporary disruption of *building* operations.

L1.2 Simple Payback. *Simple payback* can best be described by the following equation:

Simple payback = Total project cost/Annual changes in cash flow

Annual changes in cash flow typically reflect the energy savings resulting from the *EEMs* under consideration.

L1.3 Life-Cycle Cost Analysis. The evaluation tool that yields the most comprehensive analysis is called "life-cycle cost analysis," which takes all capital, energy, and operating costs into account over the useful life of a facility or *EEM*. Life-cycle cost analysis provides a means to establish the worth of a particular project and is generally required to appropriately allocate limited funding. In line with typical capital investment considerations, the present value of future benefit of investment should be greater than the initial cost.

Life-cycle cost analysis should follow the National Institute of Standards and Technology (NIST) *Life-Cycle Costing Manual* [N8] or the Building Life-Cycle Cost (BLCC) computer program.

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INFORMATIVE APPENDIX M
GUIDANCE ON BUILDING TYPE DEFINITIONS

Table M-1 lists subtypes for several *building* types/activities listed in Table 7-1. Observations in the 2012 CBECS [N12] data are not identified at the subtype level. These subtypes provide examples of more specific *building* uses included within the types. The information used to develop this table was compiled from the EIA website and communication between ORNL and the EIA. For more information on property definitions, see www.energystar.gov/buildings/tools-and-resources/list-portfoliomanager-property-types-definitions-and- use-details.

Table M-1 Subtypes Included in CBECS 2003 Commercial Building Types

No. in Table 7-1	Commercial Building Type	Includes Subtype
1	Admin/professional office	Nonprofit/social services
		Religious office
		Sales office
3	Government office	City hall/city center
6	Other office	Call center
		Contractors office
12	Other food sales	Bakery
17	Clinic/other outpatient health	Outpatient rehabilitation center
		Veterinarian
20	Entertainment/culture	Museum
		Theater
		Cinema
		Sports arena
		Casino
		Night club
22	Recreation	Gymnasium
		Health club
		Bowling alley
		Ice rink
		Field house
		Indoor racquet sports
23	Social/meeting	Community center
		Lodge
		Meeting hall
		Convention center
		Senior center

Table M-1 Subtypes Included in CBECS 2003 Commercial Building Types *(Continued)*

No. in Table 7-1	Commercial Building Type	Includes Subtype
24	Other public assembly	Armory
		Broadcasting studio
		Exhibition hall
		Funeral home
		Student activities center
		Transportation terminal
29	Other classroom education	Adult education
		Career/vocational training
		Religious education
32	Other food service	Catering service
		Coffee/bagel/doughnut shop
		Ice cream/frozen yogurt shop
		Reception hall
38	Other lodging	Convent/monastery
		Halfway house
		Retirement home
		Shelter/orphanage/children's home
41	Other retail	Beer/wine/liquor store
		Rental center
		Studio/gallery
45	Vehicle storage/maintenance	Car barn
46	Other service	Beauty parlor/barber shop
		Car wash
		Copy center/printing service
		Dry cleaner/laundromat
		Gas station
		Kennel/animal shelter/pet groom-ing
		Photo processing shop
		Tanning salon

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Note: These draft rules for the June 5, 2024 public meeting cover Chapters 1-6 only. Comments may be made at:
Comment on Chapters 1-3: https://odoe.powerappsportals.us/en-US/bps2/
Comment on Chapters 4-6: https://odoe.powerappsportals.us/en-US/bps-5-22-2024/

https://aceee2022.conferencespot.org/event-data/pdf/catalyst_activity_32596/ catalyst_activity_paper_20220810191632642_ee822729_989b_451d_ac97_09ebd933c33c.

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INFORMATIVE APPENDIX O STANDARD 100-2024 CROSSWALK

The 2024 edition of ANSI/ASHRAE/IES Standard 100 reorganizes and renumbers some tables, figures, and appendices for consistency and usability. For the convenience of users of previous editions, Table O-1 shows items that have changed, their original label, and their new label.

Table O-1 Standard 100-2024 Crosswalk

Appendices [a]		
Standard 100-2018		**Standard 100-2024**
Normative Annex A	→	Normative Appendix B
Informative Annex B	→	Informative Appendix D
Normative Annex C	→	Normative Appendix A
Informative Annex D	→	Informative Appendix I
Informative Annex E	→	Informative Appendix H
Informative Annex F	→	Deleted
Informative Annex G	→	Informative Appendix E
Informative Annex H	→	Informative Appendix L
Informative Annex I	→	Informative Appendix F
Informative Annex J	→	Informative Appendix G
Informative Annex K	→	No change
Normative Annex L	→	Normative Appendix C
Informative Annex M	→	No change
Informative Annex N	→	Informative Appendix P

Tables		
Standard 100-2018		**Standard 100-2024**
Table 5-1	→	Deleted
Table 5-2a	→	Table 5-1
Table 5-2b	→	Table 5-2
NA	→	Table 5-3 (new)
NA	→	Table 5-4 (new)
Table 7-1	→	No change
Table 7-2a (I-P)	→	No change
Table 7-2a (SI)	→	Table 7-2b (SI)
Table 7-2b (I-P)	→	Table 7-3a (I-P)
Table 7-2b (SI)	→	Table 7-3b (SI)
NA	→	Table 7-4a (I-P) (new)
NA	→	Table 7-4b (SI) (new)
Table 7-2c (I-P)	→	Table 7-5a (I-P)

Tables (*continued*)		
Standard 100-2018		**Standard 100-2024**
Table 7-2c (SI)	→	Table 7-5b (SI)
Table 7-2d (I-P)	→	Table 7-6a (I-P)
Table 7-2d (SI)	→	Table 7-6b (SI)
Table 7-3	→	Table 7-7
Table 10-1	→	Deleted
Table 10-2a (I-P)	→	Deleted
Table 10-2a (SI)	→	Deleted
Table 10-2b (I-P)	→	Deleted
Table 10-2b (SI)	→	Deleted
Table A-1 (I-P)	→	Table B-1a (I-P)
Table A-1 (SI)	→	Table B-1b (SI)
Table A-2 (I-P)	→	Table B-2a (I-P)
Table A-2 (SI)	→	Table B-2b (SI)
Table A-3 (I-P)	→	Table B-3a (I-P)
Table A-3 (SI)	→	Table B-3b (SI)
Table A-4 (I-P)	→	Table B-4a (I-P)
Table A-4 (SI)	→	Table B-4b (SI)
Table B-1	→	Table D-1
Table B-2	→	Table D-2
Table I-1	→	Table F-1
Table I-2	→	Table F-2
Table J-1	→	Table G-1
Table J-2	→	Table G-2
Table J-3	→	Table G-3
Table J-4	→	Table G-4
Table J-5	→	Table G-5
Table J-6	→	Table G-6
Table J-7	→	Table G-7
Table J-8	→	Table G-8

a. The term "annex" as used in previous editions of Standard 100 has been replaced with the term "appendix." This change is editorial only.
b. The ASHRAE climate zone map was duplicated in previous editions of the standard. The 2024 edition deletes the map where it appeared in former Annex J and all references to the climate zone map now point to Appendix E.

Table O-1 Standard 100-2024 Crosswalk *(Continued)*

Tables (*continued*)			Figures		
Standard 100-2018		**Standard 100-2024**	**Standard 100-2018**		**Standard 100-2024**
Table J-9	→	Table G-9	NA	→	Figure 4-1 (new)
NA	→	Table J2-1 (new)	NA	→	Figure 4-2 (new)
NA	→	Table J2-2 (new)	Figure 5-1 (old)	→	Figure 5-1 (new)
NA	→	Table J2-3 (new)	NA	→	Figure 10-1 (new)
NA	→	Table J2-4 (new)	Figure J-1	→	Figure E-1
NA	→	Table J2-5 (new)	Figure J-1 [b]	→	Deleted [b]
NA	→	Table J3-1 (new)	NA	→	Figure J2-1 (new)
NA	→	Table J4-1 (new)	NA	→	Figure J2-2 (new)
NA	→	Table J4-2 (new)	NA	→	Figure J2-3 (new)
NA	→	Table J5-1 (new)	NA	→	Figure J2-4 (new)
NA	→	Table J5-2 (new)	NA	→	Figure J5-1 (new)
NA	→	Table J5-3 (new)	NA	→	Figure J5-2 (new)
NA	→	Table J5-4 (new)	NA	→	Figure J5-3 (new)
NA	→	Table J5-5 (new)	NA	→	Figure J5-4 (new)
NA	→	Table J5-6 (new)	NA	→	Figure J5-5 (new)
NA	→	Table J5-7 (new)	NA	→	Figure J5-6 (new)
NA	→	Table J5-8 (new)	NA	→	Figure J6-1 (new)
NA	→	Table J6-1 (new)			
NA	→	Table J6-2 (new)			
NA	→	Table J6-3 (new)			
Table K-1	→	No change			
Table M-1	→	No change			

a. The term "annex" as used in previous editions of Standard 100 has been replaced with the term "appendix." This change is editorial only.
b. The ASHRAE climate zone map was duplicated in previous editions of the standard. The 2024 edition deletes the map where it appeared in former Annex J and all references to the climate zone map now point to Appendix E.

Note: These draft rules for the June 5, 2024 public meeting cover Chapters 1-6 only. Comments may be made at:
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INFORMATIVE APPENDIX P
ADDENDA DESCRIPTION INFORMATION

ANSI/ASHRAE/IES Standard 100-2024 incorporates ANSI/ASHRAE/IES Standard 100-2018 and Addendum a, b, c, d, e, f, g, h, i, j, and k to ANSI/ASHRAE/IES Standard 100-2018. Table P-1 lists each addendum and describes the way in which the standard is affected by the change. It also lists the ASHRAE, Illuminating Engineering Society (IES), and ANSI approval dates for each addendum.

Table P-1 Addenda to ANSI/ASHRAE/IES Standard 100-2018

Addendum	Section(s) Affected [a]	Description of Changes[b]	Approval Dates:
a	Normative Annex L	Addendum *a* replaces the existing Normative Annex L in Standard 100-2018 with a new one based on Standard 180-2018 Section 4.	February 26, 2021 (ASHRAE) February 18, 2021 (IES) February 26, 2021 (ANSI)
b	Informative Annex E	Addendum *b* adds energy efficiency measures to Informative Annex E, "Energy Efficiency Measures."	September 30, 2021 (ASHRAE) September 27, 2021 (IES) September 30, 2021 (ANSI)
c	7.1.1, 7.1.2, Table 7-1, Table 7-2a through Table 7-2d, Table 7-3, 10.1.1, 10.3.5, 10.3.6, Tables A-1 through A-4, Tables J-1 through J-4, Table J-5 (new),	Addendum *c* moves Standard 100 from a basis of CBECS 2003/RECS 2005 to an updated basis on CBECS 2012/RECS 2015. As a result, EUI target values and many values in supporting tables throughout the standard have changed. Additionally, this addendum adds three new climate zones (Zones 0A, 0B, and 1B) that represent hot and humid climate zones nearer the equator. Metrics for these climate zones are included in many tables for the update.	December 30, 2022 (ASHRAE) December 2, 2022 (IES) December 30, 2022 (ANSI)
d	3, 5.2.3, 5.2.3.1 (new), 5.2.3.2 (new), Table 5-2b, Table 5-2c (new), 7.1.2.1 (new), 11	Addendum *d* adds U.S. regional energy conversion factors to the normative section of the standard that provides AHJs with the option to use regional U.S. energy conversion factor values for electricity. The values shown in the new table were reviewed and approved in ANSI/ASHRAE Standard 105, *Standard Methods for Determining, Expressing and Comparing Building Energy Performance and Greenhouse Gas Emissions*.	June 24, 2023 (ASHRAE) January 28, 2023 (IES) July 25, 2023 (ANSI)
e	Informative Annex N (new)	Addendum *e* adds a new informative annex that provides guidance to authorities wishing to generate performance targets based on local or emissions data. Additionally, in light of increased interest in quantifying and understanding greenhouse gas (GHG) emissions related to building energy use, the annex provides a process for converting energy-based targets into GHG-based targets.	August 31, 2023 (ASHRAE) August 24, 2023 (IES) August 31, 2023 (ANSI)
f	Informative Annex I	Addendum *f* describes ANSI/ASHRAE Standard 209, *Energy Simulation Added Design for Buildings Except Low-Rise Residential Buildings*, in Informative Annex I, "Building Energy Modeling," and adds references in this annex. This addendum revises language in the first paragraph of Informative Annex I from a modeler's perspective.	January 31, 2023 (ASHRAE) January 3, 2023 (IES) January 31, 2023 (ANSI)

a. Section numbers and labels shown here reflect Standard 100-2018. Sections, figures, and tables have been reorganized and renumbered for the 2024 edition. For more information, see Informative Appendix O of this standard.
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Table P-1 Addenda to ANSI/ASHRAE/IES Standard 100-2018

Addendum	Section(s) Affected [a]	Description of Changes[b]	Approval Dates:
g	5.2.1, Figure 5-1, Table 5-1	Addendum *g* revises Section 5.2.1 to simplify and clarify the descriptive language for net energy consumption, deletes existing Figure 5-1 illustrating the net energy use concept and replaces it with a new Figure 5-1, and deletes the existing Table 5-1 completely as it does not add any useful information with respect to a building's net energy consumption.	February 28, 2023 (ASHRAE) February 2, 2023 (IES) February 28, 2023 (ANSI)
h	4.3.2.1 (new), 4.3.3.1 (new), Figure 4-1 (new), Figure 4-2 (new), 10.1.1, 10.1.4, 10.1.6, 10.3.4.7, 10.4.1, Figure 10-1 (new), Table B-2, Informative Annex F	Addendum *h* revises Sections 4.3.2, 4.3.3, 10.1, and 10.3 to simplify and clarify the compliance process for buildings with energy targets, buildings without energy targets, and residential buildings and dwelling units. It also deletes Informative Annex F and replaces it with new Figures 4-1, 4-2, and 10-1.	October 31, 2022 (ASHRAE) October 24, 2022 (IES) October 31, 2022 (ANSI)
i	Title, 1.1, 1.2, 2	Addendum *i* revises the Title, Purpose, and Scope to include carbon emission performance requirements in Standard 100.	June 24, 2023 (ASHRAE) January 28, 2023 (IES) July 25, 2023 (ANSI)
j	10.3.5, 11, Informative Annex I, Informative Annex J, Informative Annex M	Addendum *j* updates normative references within Standard 100-2018.	November 30, 2023 (ASHRAE) November 29, 2023 (IES) November 30, 2023 (ANSI)
k	3.1, 3.2, 4.1, 4.2, 4.3, Figure 4-1, Figure 4-2, 5.1, 5.2, 6.4, 6.5, 6.6, 7, 7.1, 7.2, 7.3 (new), Table 7-2c (new), Table 7-2d, Table 7-2e, 8, 8.1, 8.2, 8.3, 8.4, 8.5, 9.1, 9.2, 11, Normative Annex C	Addendum *k* aligns the body of Standard 100 with the new title, purpose, and scope (TPS) set by Addendum *i* to Standard 100-2018.	November 30, 2023 (ASHRAE) November 29, 2023 (IES) November 30, 2023 (ANSI)

a. Section numbers and labels shown here reflect Standard 100-2018. Sections, figures, and tables have been reorganized and renumbered for the 2024 edition. For more information, see Informative Appendix O of this standard.
b. These descriptions may not be complete and are provided for informative purposes only.

NOTE

Approved addenda, errata, or interpretations for this standard can be downloaded free of charge from the ASHRAE website at www.ashrae.org/technology.