

# STANDARD

**ASHRAE/IES Addendum I to  
ASHRAE/IES Standard 90.1-2022**

# **Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings**

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## FOREWORD

*Appendix I adds a new appendix, Informative Appendix M, to Standard 90.1. It is intended to be adopted by jurisdictions or rating authorities wanting to achieve net zero operational energy emissions (NZOEE) buildings with the energy code over one to three code cycles. It does not address emissions associated with other building operations, such as refrigerants or embodied emissions associated with building materials. The method requires using the performance compliance path and meeting two performance metric targets. The Site Performance Energy Index (PEI<sub>site</sub>) provides an efficiency backstop. The Greenhouse Gas Performance Emissions Index (PEI<sub>CO<sub>2e</sub></sub>) measures zero net operational emissions achievement. The modifications establish the NZOEE performance requirements for the code cycle, including updated building performance factor (BPF) values, reflected in Table 4.2.1.1, that require additional reductions in regulated energy use calculated from an estimated 11.5% overall national weighted reduction in total energy use compared to ASHRAE Standard 90.1-2022 values.*

*This addendum to the standard is designed to provide increased flexibility and therefore was not subject to cost effectiveness analysis.*

**Note:** In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~striking through~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

## Addendum I to Standard 90.1-2022

**Modify the Informative Notes at the end of Section 4.2.1.1 as follows.**

[ . . . ]

5. See Informative Appendix M for requirements that can be adopted to achieve *buildings with net zero operational energy emissions (NZOEE) based on greenhouse gas (CO<sub>2e</sub>) global warming potential over one or more code cycles, as specified by the jurisdiction or rating authority.*

**Modify the Informative notes at the end of Normative Appendix G, Section G1.2.2, as follows.**

3. See Informative Appendix M for modifications to Normative Appendix G that can be adopted to achieve *buildings with net zero operational energy emissions (NZOEE) based on greenhouse gas (CO<sub>2e</sub>) global warming potential over one or more code cycles when approved by the rating authority.*

**Add Informative Appendix M as follows. Renumber existing Informative Appendix M to Informative Appendix N. Note that all text that follows is new and should be added; to enhance readability, it is not underlined.**

**(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 M

### NET ZERO OPERATIONAL ENERGY EMISSIONS PERFORMANCE PATH

#### M1. GENERAL

Informative Appendix M provides a compliance pathway that may be adopted by a jurisdiction or *the rating authority* to achieve net zero operational energy emission (NZOEE) *buildings* over a defined number of code cycles. The amendments include changes to Section 3, Section 4, and Normative Appendix G. The method requires use of Normative Appendix G, “Performance Rating Method,” and includes two performance metric targets. The Site Performance Energy Index (PEI<sub>site</sub>) target establishes minimum *energy* efficiency, and

the Greenhouse Gas (GHG) Performance Emissions Index ( $PEI_{CO_2e}$ ) target establishes the required GHG emissions reduction.

In addressing the operational *energy* GHG emissions of *buildings*, the requirements in Informative Appendix M focus on the emissions associated with *building energy* consumption and do not address emissions associated with other *building* operations, such as refrigerants or embodied emissions associated with building materials. The calculation of operational *energy* GHG emissions accounts for both combustion and precombustion emissions. Combustion GHG emissions are the result of burning a solid, liquid, or gaseous fuel, either within the *building* or to generate electricity, steam, hot water, or chilled water that is generated outside the *building* and used within the *building*. Precombustion GHG emissions are associated with fuel extraction, processing, and transport prior to combustion within the *building* or to generate electricity, steam, hot water, or chilled water used within the *building*.

## M2. CHANGES TO SECTION 3

**M2.1** Modify the definitions in Section 3.2 as follows:

- Replace references to “annual *energy* cost” with “annual *site energy* use” in definitions of *baseline building performance* and *proposed building performance*.

**M2.2** Add definitions in Section 3.2 as follows:

***community renewable energy facility:*** a facility that produces *energy* harvested from *renewable energy resources* and is qualified as a *community energy* facility under applicable jurisdictional statutes and rules.

***directly-owned renewable energy facility:*** an off-site renewable energy system under the ownership of the building project owner.

***financial renewable energy purchase agreement:*** a financial arrangement between a renewable *energy* provider and a purchaser wherein the purchaser pays or guarantees a price to the provider for the project’s renewable *energy*.

***physical renewable energy purchase agreement:*** a contract for the purchase of renewable *energy* from a specific renewable *energy* provider to a purchaser of renewable *energy*.

***renewable energy certificate (REC):*** a market-based instrument that represents and conveys the environmental, social, and other nonpower attributes of 1 MWh of renewable electricity generation or 3412 kBtu of renewable thermal *energy* or bioenergy production and could be sold separately from the underlying physical *energy* associated with *renewable energy resources*; also known as “energy attribute” and “energy attribute certificate” (EAC).

***lower-carbon fuel:*** a gaseous or liquid fuel that has lower life-cycle greenhouse gas emissions on a per-unit *energy* basis than the equivalent fossil fuel.

## M3. CHANGES TO SECTION 4

- Replace Section 4.2.1.1 in its entirety with the language in Section M3.1.
- Add a new section, Section 4.2.1.1.1, using the language in Section M3.2 and including Table M3-1 (new Table 4.2.1.1.1).
- Add a new section, Section 4.2.1.1.2, using the language in Section M3.3. Do not include the Informative Note.
- Add new tables, Tables 4.2.1.1.2(1) and 4.2.1.1.2(2), based on values in Tables M3-2 and M3-3. Electricity GHG factors should only be included in Table 4.2.1.1.2(2) for the eGRID subregion associated with the adopting jurisdiction or *rating authority*.

**M3.1 New Buildings** (replaces Section 4.2.1.1)

New *buildings* shall comply with Sections 4.2.2 through 4.2.5 and Normative Appendix G. Where using Normative Appendix G, the following performance requirements of new *buildings*, *additions to existing buildings*, and *alterations to existing buildings* shall be met:

- a. The Site Performance Energy Index ( $PEI_{site}$ ) shall be less than or equal to the Site Performance Energy Index Target ( $PEI_{site,t}$ ) calculated in accordance with Section 4.2.1.1.1.
- b. The Greenhouse Gas Performance Emissions Index ( $PEI_{CO_2e}$ ) shall be less than or equal to the Greenhouse Gas Performance Emissions Index Target ( $PEI_{CO_2e,t}$ ) calculated in accordance with Section

4.2.1.1.2. The greenhouse gas emissions associated with the *building* operation *energy* use shall be calculated using the emission factors provided in Tables 4.2.1.1.2(1) and 4.2.1.1.2(2).

1. The electricity emission factor from Table 4.2.1.1.2(2) shall correspond to the property's eGRID sub-region and to two years after the project permit application year or 2030, whichever is earlier.
2. Emissions factors other than those in Table 4.2.1.1.2(1) shall be permitted for lower-carbon fuels where approved by the *rating authority* and where all of the following conditions are met:
  - i. Emissions factors are calculated in accordance with the California Air Resources Board Low Carbon Fuel Standard or the U.S. Environmental Protection Agency Renewable Fuel Standard; and
  - ii. Lower-carbon fuels are delivered to the *building site* under an *energy* contract with a duration of not less than 15 years and structured to survive a partial or full transfer of ownership of the *building* property.
3. Fossil fuel or electricity emissions factors other than those in Tables 4.2.1.1.2(1) and 4.2.1.1.2(2), including hourly values, shall be permitted where approved by the *rating authority* and including all of the following:
  - i. Combustion greenhouse gas emissions associated with the burning of a fuel, either within the *building* or *site* or to generate electricity, steam, hot water, or chilled water used within the *building* or *site*
  - ii. Precombustion greenhouse gas emissions associated with fuel extraction, processing, and transport, including fugitive emissions, prior to combustion within the *building* or *site* or to generate electricity or thermal *energy* used within the *building* or *site*
  - iii. Carbon dioxide (CO<sub>2</sub>), nitrous oxide (N<sub>2</sub>O), and methane (CH<sub>4</sub>)
  - iv. Where converted to carbon dioxide equivalent (CO<sub>2e</sub>), a 20-year global warming potential basis
  - v. Where applicable, transmission and distribution losses
4. Distributed thermal *energy* emission factors other than those in Table 4.2.1.1.2(1) shall be permitted where approved by the *rating authority* and accounting for all of the following:
  - i. Input fuel and electricity emission factors in accordance with Tables 4.2.1.1.2(1) and 4.2.1.1.2(2) and Section 4.2.1.1(b)(i), 4.2.1.1(b)(ii), or 4.2.1.1(b)(iii)
  - ii. Conversion efficiency of the heating or cooling plant
  - iii. Auxiliary equipment and distribution losses associated with delivery of thermal *energy* to the *building*

**Informative Note:** As Sections 4.2.1.2 and 4.2.1.3 are not amended, it is intended for *existing buildings* and *alterations* to have the option to comply either prescriptively in accordance with Sections 5 through 11; using Section 12, “Energy Cost Budget”; or via Normative Appendix G, “Performance Rating Method,” as modified by this appendix.

**Informative Note:** Tables 4.2.1.1.2(1) and 4.2.1.1.2(2) list aggregate annual emissions of GHGs using standard CO<sub>2</sub> equivalent (CO<sub>2e</sub>) emission metrics for CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O for a 20-year GWP emissions rate period. When comparing or combining CO<sub>2e</sub> emission values, care should be taken to ensure that the values have been computed for a consistent GWP time horizon.

### M3.2 Site Performance Energy Index (new section 4.2.1.1.1)

The Site Performance Energy Index Target (PEI<sub>site,t</sub>) is calculated as follows:

$$PEI_{site,t} = \frac{BBUEU_{site} + BPF_{site} \times BBREU_{site}}{BBEU_{site}}$$

where

- PEI<sub>site,t</sub> = Site Performance Energy Index Target
- BBUEU<sub>site</sub> = *baseline building design unregulated site energy use*; the portion of the annual *site energy* use of a *baseline building design* that is due to *unregulated energy use*
- BPF<sub>site</sub> = *building performance factor site* from Table 4.2.1.1.1. For *building* area types not listed in Table 4.2.1.1.1, use “All others.” Where a *building* has multiple *building* area types, the required BPF shall be equal to the area-weighted average of the *building* area types based on their *gross floor area*
- BBREU<sub>site</sub> = *baseline building design regulated site energy use*; the portion of the annual *site energy* use of a *baseline building design* that is due to *regulated energy use*
- BBEU<sub>site</sub> = *baseline building design site energy use* of a *baseline building design* that is due to both *regulated energy use* and *unregulated energy use*.

**Table M3-1 Building Performance Factor (BPF<sub>site</sub>) (new Table 4.2.1.1.1)**

Building Area Type	Climate Zone																		
	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
Multifamily	0.55	0.54	0.58	0.56	0.59	0.59	0.61	0.59	0.56	0.49	0.56	0.53	0.46	0.51	0.53	0.44	0.47	0.45	0.47
Healthcare/hospital	0.47	0.46	0.47	0.46	0.45	0.43	0.43	0.45	0.44	0.42	0.43	0.42	0.43	0.43	0.46	0.42	0.45	0.44	0.45
Hotel/motel	0.57	0.56	0.58	0.56	0.57	0.55	0.57	0.57	0.59	0.54	0.56	0.57	0.53	0.55	0.57	0.51	0.53	0.50	0.49
Office	0.40	0.40	0.40	0.39	0.38	0.38	0.37	0.39	0.34	0.34	0.37	0.35	0.35	0.37	0.35	0.34	0.35	0.31	0.33
Restaurant	0.57	0.52	0.52	0.51	0.54	0.48	0.55	0.52	0.55	0.55	0.55	0.56	0.57	0.58	0.57	0.59	0.61	0.60	0.61
Retail	0.38	0.36	0.35	0.35	0.32	0.30	0.31	0.31	0.31	0.31	0.31	0.33	0.34	0.31	0.34	0.34	0.33	0.33	0.34
School	0.40	0.42	0.44	0.42	0.40	0.37	0.40	0.37	0.40	0.31	0.35	0.39	0.32	0.36	0.38	0.32	0.31	0.30	0.32
Warehouse	0.20	0.21	0.17	0.19	0.16	0.16	0.18	0.15	0.13	0.25	0.18	0.20	0.31	0.25	0.20	0.36	0.30	0.32	0.35
All others	0.50	0.49	0.49	0.48	0.43	0.39	0.42	0.41	0.45	0.41	0.40	0.44	0.41	0.42	0.44	0.42	0.42	0.41	0.42

**M3.3 Greenhouse Gas Performance Emissions Index** (new section 4.2.1.1.2)

The Greenhouse Gas Performance Emissions Index Target ( $PEI_{CO_{2e,t}}$ ) is specified as follows.

$$PEI_{CO_{2e,t}} = 0$$

**Informative Note:** The target can be set to align with a *rating authority* timeline for achieving zero emissions with *energy codes*. For example, a target value of zero achieves zero emissions in the current code cycle. If the *rating authority* plans to achieve zero emissions over two code cycles, the target equals 0.5 in the current code cycle and 0 in the second code cycle. If the goal is to achieve zero emissions over three code cycles, the target equals 0.67 in the current code cycle, 0.5 in the second code cycle, and 0 in the third code cycle. *Rating authorities* may choose to adopt a different time frame for achieving zero emissions for *alterations*

**Table M3-2 Greenhouse Gas Emission Factors (new Table 4.2.1.1.2[1])**

Greenhouse Gas Emissions Associated with Site Energy Usage	CO <sub>2e</sub> GWP-20 Emissions	
	(lb/MWh)	(kg/MWh)
<i>Fuels Delivered to Buildings</i>		
Natural gas	611	277
LPG or propane	650	295
Fuel oil (residual)	737	334
Fuel oil (distillate)	714	324
Coal	842	382
Gasoline	742	337
<i>Lower-carbon fuels</i>	Calculated in accordance with Section 4.2.1.1(b)(ii)	
Other fuels not specified in this table	842	382
<i>Thermal Energy</i>		
Chilled water	0.24*electricity emission factor for the appropriate eGrid subregion	
Steam	1028	466
Hot water	971	440

**Table M3-3 Electricity Greenhouse Gas Emission Factors (new Table 4.2.1.1.2[2])<sup>a</sup>**

eGRID Subregion	CO <sub>2e</sub> GWP-20 Emissions (lb/MWh)						
	20-Year Analysis Start Year <sup>b</sup>						
	2024	2025	2026	2027	2028	2029	2030
AZNM <sub>c</sub>	458	439	438	438	446	454	465
CAMX <sub>c</sub>	132	106	91	75	67	59	53
ERCT <sub>c</sub>	258	230	216	199	197	195	197
FRCC <sub>c</sub>	684	691	706	723	747	772	793
MROE <sub>c</sub>	639	628	628	628	633	638	645
MROW <sub>c</sub>	420	407	409	412	423	433	442
NEW <sub>c</sub>	648	625	608	590	577	565	556
NWPP <sub>c</sub>	317	283	263	243	235	227	227
NYST <sub>c</sub>	210	169	134	99	76	53	40
RFCE <sub>c</sub>	909	902	901	900	906	912	918
RFCM <sub>c</sub>	1141	1140	1140	1138	1137	1136	1135
RFCW <sub>c</sub>	990	977	967	955	947	939	933
RMPA <sub>c</sub>	485	454	435	417	412	407	410
SPNO <sub>c</sub>	432	411	408	406	418	431	442

**Table M3-3 Electricity Greenhouse Gas Emission Factors (new Table 4.2.1.1.2[2])<sup>a</sup> (Continued)**

eGRID Subregion	CO <sub>2e</sub> GWP-20 Emissions (lb/MWh)						
	20-Year Analysis Start Year <sup>b</sup>						
	2024	2025	2026	2027	2028	2029	2030
SPSOc	498	472	461	450	452	454	464
SRMVc	964	935	910	881	859	837	816
SRMWc	629	599	581	556	541	527	518
SRSOc	999	1003	1018	1027	1043	1058	1064
SRTVc	1151	1162	1173	1179	1183	1188	1184
SRVCc	548	518	500	479	465	452	438

a. The total (combined combustion and precombustion) greenhouse gas emissions factors (associated with CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O) are listed in Table 4.2.1.1.2(1) for fossil fuels and thermal energy and Table 4.2.1.1.2(2) for the production of electricity. The delivered fossil fuel factors are U.S. averages based on 2019 EIA and EPA data and a 20-year greenhouse gas global warming potential. The electricity conversion factors are 2022 Cambium long-run marginal emission rates based on 20-year greenhouse gas global warming potential. The electricity data are site end-use values for the Cambium mid-case scenario, based on a 20-year levelized analysis period, zero discount rate, and a 20-year greenhouse gas global warming period. The Cambium eGRID subregions are based on balancing area and do not completely align with EPA eGRID subregions, which are based on utility service territory. Lookup tables that indicate eGRID<sub>c</sub> subregions by zip code or county are included in the published Cambium 2022 LRMER workbooks available at <https://data.nrel.gov/submissions/206>. More details on the Cambium input assumptions and methodology are described in the documentation report available at <https://www.nrel.gov/docs/fy23osti/84916.pdf>.

b. The analysis start year corresponds to the year that is two years after the project permit application.



#### M4. CHANGES TO NORMATIVE APPENDIX G

- Replace Section G1.2.2 in its entirety with the language in Section M4.1.
- Add a new section, Section G1.2.2.1, “Site Performance Energy Index Calculation,” using the language in Section M4.2.
- Add a new table, Table G1.2.2.2-1, using the values in Table M4-1.
- Add a new section, Section G1.2.2.2, “Greenhouse Gas Performance Emissions Index Calculation,” using the language in Section M4.3.
- Add a new section, G1.2.2.3, “Off-Site Renewable Energy Procurement,” using the language in Section M4.4.
- Add a new section, G1.2.2.3.1, “Off-Site Procurement Paths,” using the language in Section M4.4.1.
- Add a new section, G1.2.2.3.2, “Off-Site Contract Terms,” using the language in Section M4.4.2.
- Add a new section, G1.2.2.3.3, “Renewable Energy Certification Documentation,” using the language in Section M4.4.3.
- Replace Section G1.3.2, item n, in its entirety with “Greenhouse gas emission conversion factors used to calculate the *proposed design* greenhouse gas emissions.”
- Append Section G1.3.2, item q, to include “production and off-site renewable energy procurement” after the term *on-site renewable energy*.

##### M4.1 Performance Rating Calculation (replaces Section G1.2.2)

The performance of the *proposed design* is calculated in accordance with provisions of this appendix using the formulas provided in Section G1.2.2.1 and Section G1.2.2.2.

Both the *proposed building performance* and the *baseline building performance* shall include all end-use load components within and associated with the *building* when calculating the Performance Site Energy Index and the Performance Emissions Index Greenhouse Gas.

**Exception to G1.2.2:** Energy used to recharge or refuel vehicles that are used for off-site transportation purposes shall not be modeled in the *baseline building performance* or the *proposed building performance*.

##### M4.2 Site Performance Energy Index Calculation (new Section G.1.2.2.1)

$$PEI_{site} = \frac{PBGEU_{site}}{BBEU_{site}}$$

where

$PEI_{site}$  = Site Performance Energy Index

$PBGEU_{site}$  = Proposed *building gross site energy* use; the regulated and unregulated *site energy* use of the *proposed design*, calculated in accordance with Normative Appendix G, excluding the contribution of *on-site renewable energy* production and off-site renewable energy procurement

$BBEU_{site}$  = *baseline building design site energy* use is the regulated and *unregulated energy use* of the *baseline building design* calculated in accordance with Section G1.2

##### M4.3 Greenhouse Gas Performance Emissions Index Calculation (new Section G.1.2.2.2)

If  $PBGEU_{CO_2e} > 0$

$$\frac{(PEI_{CO_2e} = PBNEU_{CO_2e})}{PBGEU_{CO_2e}}$$

If  $PBGEU_{CO_2e} = 0$  or  $PBNEU_{CO_2e} = 0$

$$PEI_{CO_2e} = 0$$

where

$PEI_{CO_2e}$  = Greenhouse Gas Performance Emissions Index

$PBNEU_{CO_2e}$  = the *proposed design* emissions associated with the proposed *building net site energy*

including the emission reductions associated with *on-site renewable energy* production and *off-site renewable energy* procurement, based on the greenhouse gas emission factors in accordance with Section 4.2.1.1(b)

$PBGEU_{CO_2e}$  = the *proposed design* gross greenhouse gas emissions associated with the proposed *building site energy* use, excluding the emission reductions associated with *on-site renewable energy* production and *off-site renewable energy* procurement, based on greenhouse gas emission factors provided in accordance with Section 4.2.1.1(b)

and

$$PBNEU_{CO_2e} = PBGEU_{CO_2e} - AE$$

$$AE = \sum_{i=1}^n RE_i \times REPF_i \times GHG_i$$

where

AE = the avoided emissions from *on-site renewable energy* production and *off-site renewable energy* procured in accordance with Section G1.2.2.3

$RE_i$  = annual *energy* generation for the  $i^{th}$  *renewable energy* procurement method or class

$n$  = the total number of *renewable energy* production and procurement methods or classes

$REPF_i$  = *renewable energy* procurement factor for the  $i^{th}$  *renewable energy* procurement method or class from Table G1.2.2.2-1

$GHG_i$  = greenhouse gas emission conversion factor from Tables 4.2.1.1.2(1) and 4.2.1.1.2(2); for *renewable electricity* resources for projects within the continental U.S., select the value corresponding to the property's eGRID subregion or use locally derived values approved by the *rating authority*

**Table M4-1 Renewable Energy Procurement Factors (new Table G1.2.2.2-1)**

Class	Procurement Factor	Classification
1	1.0	On-site production
2	1.0	Off-site procurement—in <i>buildings</i> that a. include <i>equipment</i> for <i>on-site renewable energy</i> with a rated capacity of not less than 7.5 W/ft <sup>2</sup> of roof area, or b. meet Exception 1, 2, or 3 to Section 10.5.1.1
3	0.75	Off-site procurement—other qualifying with Section G1.2.2.3.1



## **POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES**

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

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### **About ASHRAE**

Founded in 1894, ASHRAE is a global professional society committed to serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration, and their allied fields.

As an industry leader in research, standards writing, publishing, certification, and continuing education, ASHRAE and its members are dedicated to promoting a healthy and sustainable built environment for all, through strategic partnerships with organizations in the HVAC&R community and across related industries.

To stay current with this and other ASHRAE Standards and Guidelines, visit [www.ashrae.org/standards](http://www.ashrae.org/standards), and connect on LinkedIn, Facebook, Twitter, and YouTube.

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ASHRAE offers its Standards and Guidelines in print, as immediately downloadable PDFs, and via ASHRAE Digital Collections, which provides online access with automatic updates as well as historical versions of publications. Selected Standards and Guidelines are also offered in redline versions that indicate the changes made between the active Standard or Guideline and its previous edition. For more information, visit the Standards and Guidelines section of the ASHRAE Bookstore at [www.ashrae.org/bookstore](http://www.ashrae.org/bookstore).

### **IMPORTANT NOTICES ABOUT THIS STANDARD**

**To ensure that you have all of the approved addenda, errata, and interpretations for this Standard, visit [www.ashrae.org/standards](http://www.ashrae.org/standards) to download them free of charge.**

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