STANDARD

ANSI/ASHRAE/IES Addenda by, ck, and cp to
ANSI/ASHRAE/IES Standard 90.1-2019

Energy Standard for Buildings Except Low-Rise Residential Buildings

Approved by ASHRAE Standards Committee on June 26, 2020; by the ASHRAE Board of Directors on July 1, 2020; by the Illuminating Engineering Society on May 19, 2020; and by the American National Standards Institute on July 31, 2020.

This addendum was approved by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. Instructions for how to submit a change can be found on the ASHRAE® website (https://www.ashrae.org/continuous-maintenance).

The latest edition of an ASHRAE Standard may be purchased on the ASHRAE website (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 678-539-2129. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

 ISSN 1041-2336

www.ansi.org

SPECIAL NOTE

This American National Standard (ANS) is a national voluntary consensus Standard developed under the auspices of ASHRAE. *Consensus* is defined by the American National Standards Institute (ANSI), of which ASHRAE is a member and which has approved this Standard as an ANS, as "substantial agreement reached by directly and materially affected interest categories. This signifies the concurrence of more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that an effort be made toward their resolution." Compliance with this Standard is voluntary until and unless a legal jurisdiction makes compliance mandatory through legislation.

ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

ASHRAE Standards are prepared by a Project Committee appointed specifically for the purpose of writing the Standard. The Project Committee Chair and Vice-Chair must be members of ASHRAE; while other committee members may or may not be ASHRAE members, all must be technically qualified in the subject area of the Standard. Every effort is made to balance the concerned interests on all Project Committees.

The Senior Manager of Standards of ASHRAE should be contacted for

a. interpretation of the contents of this Standard,
b. participation in the next review of the Standard,
c. offering constructive criticism for improving the Standard, or
d. permission to reprint portions of the Standard.

(This foreword 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.)

FOREWORD

Addendum by adds a minimum prescriptive requirement for onsite renewable energy. The renewable energy resources are defined within the addendum; however, the specific resource to be used are left up to the designer or building owner. The listed capacity requirement, as well as the scalar evaluation, is based on photovoltaic generation, as that is the most ubiquitous and cost-effective renewable energy resource and equipment/system currently available across the industry. The renewable energy capacity component was determined through a comparative analysis exercise considering economics, (roof) space competition, annual energy production/contribution to the building energy budget, and equivalences against other energy efficiency measures. The annual purchased energy reduction budget for this renewable energy proposal, based on the PI prototype models considered, is 4.5%. The building prototypes and solar zones evaluated passed the ASHRAE scalar assessment for cost effectiveness.

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

Addendum by to Standard 90.1-2019

Modify Section 3.2 as shown (I-P and SI units).

3.2 Definitions

on-site renewable energy: *energy* ~~generated~~ from *renewable energy resources* ~~produced~~ harvested at the *building* site.

renewable energy resources: *energy* from solar, wind, biomass or hydro, or extracted from hot fluid or steam heated within the earth.

~~***site-solar energy:*** thermal, chemical, or electrical *energy* derived from direct conversion of incident solar radiation at the *building* site and used to offset consumption of purchased *fuel* or electrical *energy* supplies. For the purposes of applying this standard, *site-solar energy* shall not include passive heat gain through *fenestration systems*~~.

Modify Section 6 as shown (I-P and SI units).

[. . .]

Exceptions to 6.5.2.1:

[. . .]

4. Zones where at least 75% of the *energy* for *reheating* or for providing warm air in mixing *systems* is provided from *site-recovered energy* (including condenser heat) or ~~*site-solar energy*~~ *on-site renewable energy.*

[. . .]

Exceptions to 6.5.2.3:

[. . .]

4. *Systems* serving *spaces* where specific humidity levels are required to satisfy process needs, such as a vivarium; museum; surgical suite; pharmacy; and *buildings* with refrigerating *systems*, such as supermarkets, refrigerated warehouses, and ice arenas, and where the *building* includes *site-recovered energy* or ~~*site-solar energy*~~ *on-site renewable energy* that provide *energy* equal to at least 75% of the annual *energy* for *reheating* or for providing warm air in mixing *systems*. This exception does not apply to *computer rooms*.
5. At least 90% of the annual *energy* for *reheating* or for providing warm air in mixing *systems* is provided from *site-recovered energy* (including condenser heat) or ~~*site-solar energy*~~ *on-site renewable energy.*

[. . .]

Exceptions to 6.5.3.5:

[. . .]

5. *Systems* in which at least 75% of the *energy* for *reheating* (on an annual basis) is from *site recovered energy* or ~~*site-solar energy*~~ *on-site renewable energy*.

[. . .]

Exceptions to 6.5.6.1.2:

[. . .]

3. Heating energy recovery where more than 60% of the *outdoor air* heating *energy* is provided from *site-recovered energy* or ~~*site-solar energy*~~ *on-site renewable energy*.

[. . .]

Exceptions to 6.5.6.2.2:

[. . .]

2. Facilities that provide 60% of their *service water heating* from ~~*site-solar energy*~~ *on-site renewable energy* or *site-recovered energy* or from other sources

[. . .]

Modify Section 7 as shown (I-P and SI units).

Exception to 7.4.5.2: *Pools* deriving over 60% of the *energy* for heating from *site-recovered energy* or ~~*site-solar energy*~~ *on-site renewable energy*.

[. . .]

Exceptions to 7.5.3:

1. Where 25% of the annual *service water-heating* requirement is provided by ~~*site-solar energy*~~ *on-site renewable energy* or *site-recovered energy*.

[. . .]

Modify Section 10 as shown (I-P and SI units).

10. OTHER EQUIPMENT

10.1 General

10.1.1 Scope. This section applies only to the *equipment* described below.

[. . .]

10.2 Compliance Paths. Other equipment shall comply with Section 10.2.1 and Section 10.2.2.

10.2.1 Requirements for All Compliance Paths. Other equipment shall comply with Section 10.1, "General"; Section 10.4, "Mandatory Provisions"; Section 10.5, "Prescriptive Path" and Section 10.8, "Product Information."

[. . .]

10.5 Prescriptive Compliance Path ~~(Not Used)~~

10.5.1 *Renewable Energy Resources*. *Buildings* shall be served by *renewable energy resources* complying with Section 10.5.1.1.

10.5.1.1 On-Site Renewable Energy. The *building* site shall have *equipment* for *on-site renewable energy* with a rated capacity of not less than 0.25 W/ft² or 0.85 Btu/ft^2 (2.7W/m^2) multiplied by the sum of the *gross conditioned floor area* for all floors up to the three (3) largest floors.

Exceptions to 10.5.1.1:

1. Any *building* located where an unshaded flat plate collector oriented toward the equator and tilted at an angle from horizontal equal to the latitude receives an annual daily average incident solar radiation less than 3.5 kWh/m^2·day (1.1 kBtu/ft^2·day).
2. Any *building* where more than 80% of the *roof* area is covered by any combination of *equipment* other than for *on-site renewable energy systems*, planters, vegetated space, *skylights*, or occupied *roof* deck.

3. Any *building* where more than 50% of *roof* area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the *building* for more than 2500 annual hours between 8:00 a.m. and 4:00 p.m.
4. New construction or *additions* in which the sum of the *gross conditioned floor area* of the three largest floors of the new construction or *addition* is less than 10,000 ft^2 (1000 m^2).
5. *Alterations* that do not include *additions*.

(This foreword 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.)

FOREWORD

Addendum ck adds language to Section 11 to address new renewable energy requirements in Addendum by. The approach allows a proposed design that does not include renewable energy required by Section 10.5.1 a trade-off against other prescriptive requirements in the standard. In that case, the renewable energy allowance included in the budget building design will be based on a horizontal photovoltaic array with a rated capacity equal to but not to exceed the requirement in Section 10.5.1.1. For proposed designs that include an on-site renewable energy system, the budget building design allowance will be based on the proposed renewable energy system design with a rated capacity equal to but not to exceed the requirement in Section 10.5.1.1.

This addendum impacts an optional performance path in the standard designed to provide increased flexibility and therefore was not subjected to cost effectiveness analysis.

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

Addendum ck to Standard 90.1-2019

Revise Section 11 as shown (I-P and SI units).

11.4 Simulation General Requirements

11.4.1 Simulation Program. The *simulation program* shall be a computer-based program for the analysis of *energy* consumption in *buildings*. For components that cannot be modeled by the *simulation program*, the exceptional calculation methods requirements in Section 11.4.5 shall be used.

Exception to 11.4.1: When approved by the *adopting authority*, a separate computer-based program shall be permitted to be used to calculate *on-site renewable energy*.

Informative Note: ASHRAE Standing Standard Project Committee 90.1 recommends that the *simulation program* implement the rules of Section 11 that control simulation inputs and outputs be adopted for the purposes of easier use and simpler compliance.

[. . .]

11.4.3 Renewable, Recovered, and Purchased Energy

11.4.3.1 On-Site Renewable Energy and Site-Recovered Energy. *Site-recovered energy* shall not be considered *purchased energy* and shall be subtracted from the *proposed design energy* consumption prior to calculating the *design energy cost*. *On-site renewable energy* shall be subtracted from the *proposed design energy* consumption prior to calculating the *design energy cost* provided that the building owner

a. owns the *on-site renewable energy system*,
b. has signed a lease agreement for the *on-site renewable energy system* for at least 15 years or
c. has signed a contractual agreement to purchase *energy* generated by the *on-site renewable energy system* for at least 15 years.

The reduction in *design energy cost* associated with *on-site renewable energy* that exceeds the *on-site renewable energy* required by Section 10.5.1.1 shall be no more than 5% of the calculated *energy cost budget.*

On-site renewable energy included in the *budget building design* shall be subtracted from the *budget building design* energy consumption prior to calculating the *energy cost budget.*

11.4.3.2 Annual Energy Costs. The *design energy cost* and *energy cost budget* shall be determined using rates for *purchased energy* (such as electricity, gas, oil, propane, steam, and chilled water) that are approved by the *adopting authority*. Where *on-site renewable energy* or *site-recovered energy* is ~~used~~ in excess of what is required in the *budget building design* by Table 11.5.1, the *budget building design* shall be based on the *energy* source used as the backup

Table 11.5.1 Modeling Requirements for Calculating Design Energy Cost and Energy Cost Budget

Proposed Design **(Column A)** ***Design Energy Cost*** **(DEC)**	***Budget Building Design*** **(Column B)** ***Energy Cost Budget*** **(ECB)**
15. On-Site Renewable Energy	
On-site renewable energy in the *proposed design* shall be determined as follows: a. Where a complete *system* providing on-site *renewable energy* exists, the model shall reflect the actual *system* type using actual component capacities and efficiencies. b. Where a *system* providing on-site *renewable energy* has been designed, the *system* model shall be consistent with design documents. c. Where no *system* exists or is specified to provide *on-site renewable energy*, no *system* shall be modeled.	*On-site renewable energy* shall be included in the *budget building design* when required by Section 10.5.1, and shall be determined as follows: a. Where a *system* providing *on-site renewable energy* has been modeled in the *proposed design*, the same *system* shall be modeled identically in the *budget building design*, except the rated capacity shall meet the requirements of Section 10.5.1.1. Where more than one type of *on-site renewable* energy system is modeled, the total capacities shall be allocated in the same proportion as in the *proposed design*. b. Where no *system* exists or is specified to provide *on-site renewable energy* in the *proposed design*, *on-site renewable energy* shall be modeled as an unshaded photovoltaic system with the following physical characteristics: • Size: Rated capacity per Section 10.5.1.1 • Module Type: Crystalline silicon panel with a glass cover, 19.1% nominal efficiency and temperature coefficient of –0.47%/°C; performance shall be based on a reference temperature of 77°F (25°C) and irradiance of 317 Btu/ft^2·h (1000 W/m^2). • Array Type: Rack-mounted array with installed nominal operating cell temperature (INOCT) of 103°F (45°C) • Total system losses (DC output to AC output): 11.3% • Tilt: 0-degrees (mounted horizontally) • Azimuth:180 degrees If the *on-site renewable energy system* cannot be modeled in the *simulation program*, Section 11.4.5 shall be used.

energy source, or electricity if no backup *energy* source has been specified. Where the proposed design includes *on-site electricity generation systems* other than *on-site renewable energy systems*, the baseline design shall include the same generation systems excluding its *site-recovered energy*.

(This foreword 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.)

FOREWORD

Addendum cp adds language to Normative Appendix G to address the new proposed renewable energy requirements in Addendum by. The approach allows a proposed design that does not include renewable energy required by Section 10.5.1 a method of trade off against other prescriptive requirements in the standard. In that case the renewable energy allowance included in the budget building design will be based on a horizontal photovoltaic array with a rated capacity equal to but not to exceed the requirement in Section 10.5.1.1. For proposed designs that include an on-site renewable energy system, the budget building design allowance will be based on the proposed renewable energy system design with a rated capacity equal to but not to exceed the requirement in Section 10.5.1.1.

This addendum impacts an optional performance path in the standard designed to provide increased flexibility and therefore was not subjected to cost effectiveness analysis.

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

Addendum cp to Standard 90.1-2019

Modify Section 4.2.1.1 as shown (I-P and SI units).

4.2.1.1 New Buildings. New *buildings* shall comply with Sections 4.2.2 through 4.2.5 and either the provisions of

a. Section 5, "*Building Envelope*"; Section 6, "Heating, Ventilating, and Air Conditioning"; Section 7, "*Service Water Heating*"; Section 8, "Power"; Section 9, "Lighting"; and Section 10, "Other *Equipment*," or
b. Section 11, "*Energy Cost Budget* Method," or
c. Normative Appendix G, "*Performance Rating Method*."

When using Normative Appendix G, the Performance Cost Index (PCI) of new *buildings*, *additions* to *existing buildings*, and/or *alterations* to *existing buildings* shall be less than or equal to the Performance Cost Index target (PCI_t) when calculated in accordance with the following:

$$PCI_t = [BBUEC + (BPF \times BBREC) \underline{- PRE}]/BBP$$

where

PCI = Performance Cost Index calculated in accordance with Section G1.2.

BBUEC = baseline *building* unregulated *energy* cost, the portion of the annual *energy* cost of a *baseline building design* that is due to *unregulated energy use*.

BBREC = baseline *building* regulated *energy* cost, the portion of the annual *energy* cost of a *baseline building design* that is due to *regulated energy use*.

BPF = *building* performance factor from Table 4.2.1.1. For *building* area types not listed in Table 4.2.1.1 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.

BBP = *baseline building performance*.

PBP = *proposed building performance*, including the reduced, annual purchased energy cost associated with all *on-site renewable energy* generation systems.

PBP_{nre} = *proposed building performance* without any credit for reduced annual energy costs from on-site renewable energy generation systems.

$\underline{PBP_{pre}}$ = *proposed building performance*, excluding any renewable energy system in the proposed design and including an *on-site renewable energy system* that meets but

does not exceed the requirements of Section 10.5.1.1 modeled following the requirements for a *budget building design* in Table 11.5.1.

PRE = $PBP_{nre} - PBP_{pre}$.

When $(PBP_{pre} - PBP)/BBP > 0.05$, new *buildings*, *additions* to *existing buildings*, and/or *alterations* to *existing buildings* shall comply with the following:

$$PCI + [(PBP_{pre} - PBP)/BBP] - 0.05 < PCI_t$$

Informative Notes:

1. PBP_{nre} = *proposed building performance*, no renewable energy
2. PBP_{pre} = *proposed building performance*, prescriptive renewable energy
3. PRE = prescriptive renewable energy

Modify Section G2.2 as shown (I-P and SI units).

G2.2 Simulation Program. The *simulation program* shall be a computer-based program for the analysis of *energy* consumption in *buildings* (a program such as, but not limited to, DOE-2, BLAST, or EnergyPlus). The *simulation program* shall include calculation methodologies for the *building* components being modeled. For components that cannot be modeled by the *simulation program*, the exceptional calculation methods requirements in Section shall be used.

Exception to G2.2: When approved by the *adopting authority*, a separate computer-based program shall be permitted to be used to calculate *on-site renewable energy*.

Modify Table G3.1 as shown (I-P and SI units).

Table G3.1 Modeling Requirements for Calculating Proposed and Baseline Building Performance

No.	*Proposed Building Performance*	*Baseline Building Performance*
18. ***On-Site Renewable Energy***		
	On-site renewable energy in the *proposed building performance* shall be determined as follows: a. Where a complete *system* providing on-site *renewable energy* exists, the model shall reflect the actual *system* type using actual component capacities and efficiencies. b. Where a *system* providing on-site *renewable energy* has been designed, the *system* model shall be consistent with design documents. c. Where no *system* exists or is specified to provide *on-site renewable energy*, no *system* shall be modeled.	*On-site renewable energy* shall not be included in the *baseline building performance*.

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.

ASHRAE · 1791 Tullie Circle NE · Atlanta, GA 30329 · www.ashrae.org

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, and connect on LinkedIn, Facebook, Twitter, and YouTube.

Visit the ASHRAE Bookstore

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 version. For more information, visit the Standards and Guidelines section of the ASHRAE Bookstore at 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 to download them free of charge.

Addenda, errata, and interpretations for ASHRAE Standards and Guidelines are no longer distributed with copies of the Standards and Guidelines. ASHRAE provides these addenda, errata, and interpretations only in electronic form to promote more sustainable use of resources.

7/20