ANSI/ASHRAE/ICC/USGBC/IES Addendum bm to

Standard for the Design of High-Performance Green Buildings
Except Low-Rise Residential Buildings

The Complete Technical Content of the International Green Construction Code®

Approved by the ASHRAE Standards Committee on June 22, 2019; by the ASHRAE Board of Directors on June 26, 2019; by the International Code Council on June 10, 2019; by the USGBC Board of Directors on July 9, 2019; by the IES Board of Directors on June 10, 2019; and by the American National Standards Institute on July 24, 2019.

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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.

SPECIAL NOTE

CONSULTATION

ASHRAE uses its best efforts to promulgate Standards and Guidelines for the benefit of the public in light of available information and accepted industry practices. However, ASHRAE does not guarantee, certify, or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with ASHRAE’s Standards or Guidelines or that any tests conducted under its Standards or Guidelines will be nonhazardous or free from risk.

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ASHRAE Standards and Guidelines are established to assist industry and the public by offering a uniform method of testing for rating purposes, by suggesting safe practices in designing and installing equipment, by providing proper definitions of this equipment, and by providing other information that may serve to guide the industry. The creation of ASHRAE Standards and Guidelines is determined by the need for them, and conformance to them is completely voluntary.

In referring to this Standard or Guideline and in marking of equipment and in advertising, no claim shall be made, either stated or implied, that the product has been approved by ASHRAE.
The proposed building PCI, without consideration of renewables, shall comply with the requirements of ANSI/ASHRAE/USGBC Standard 90.1, Section 4.2.1.1.

[...]

On-site renewable energy systems in the proposed design shall be calculated using the procedures in Normative Appendix C. For mixed-use buildings, the building performance factor (BPF) shall be determined by weighting each building type by floor area. A building project served in whole or in part by a district energy plant shall follow the modeling requirements contained in Normative Appendix C, Section C1.3, in order to comply with this section.

7.5.2 Annual Carbon Dioxide Equivalent (CO2e). The proposed design shall have an annual CO2e equal to or less than the annual CO2e of the baseline building design multiplied by the building performance factor (BPF) target determined from Table 7.5.2A using the Performance Rating Method in ANSI/ASHRAE/IES Standard 90.1, Normative Appendix G. To determine the annual CO2e for each energy source in the baseline building design and proposed design, the energy consumption shall be multiplied by the CO2e emission factors from Table 7.5.2B. A building project served in whole or in part by a district energy plant shall follow the modeling requirements contained in Normative Appendix C, Section C1.3, in order to comply with this section.

Modify Normative Appendix C as shown.

NORMATIVE APPENDIX C
PERFORMANCE OPTION FOR ENERGY EFFICIENCY

[...]

C1.3 Modeling of District Energy Systems. A building project served in whole or in part by a district energy plant shall comply with either Section C1.3.1 or C1.3.2.

C1.3.1 Modeling Purchased District Heating or Cooling. The proposed building performance and baseline building performance shall be calculated using the cost of purchased district heating or cooling for compliance with Section 7.5.1 as defined in Standard 90.1, Sections G3.1.1.1, G3.1.1.2, and...
G3.1.1.3. CO₂ emission factors in Table 7.5.2B for district heating or cooling shall be used for compliance with Section 7.5.2.

C1.3.2 Performance Modeling of District Energy Systems. Two model simulation runs shall be completed for both the proposed building performance and baseline building performance in accordance with Sections C1.3.2(a) and C1.3.2(b).

a. The proposed building performance and baseline building performance shall be calculated using the cost of purchased district heating or cooling as defined in Standard 90.1, Sections G3.1.1.1, G3.1.1.2, and G3.1.1.3. The proposed building shall comply with Standard 90.1 using the Performance Rating Method.

b. Model the district heating or cooling in the building project using Standard 90.1, Normative Appendix G, with the following additions and alterations. All demands on the district energy system from the building project shall be modeled using time steps no longer than one hour. Documentation of district energy systems in the proposed building performance model shall be provided in accordance with the requirements defined in Standard 90.1, Section G2.5, “Exceptional Calculation Methods.” Projects shall comply with either Section C1.3.2(b)(1) or C1.3.2(b)(2).

1. District Energy System Monitoring Path. Data from energy metering equipment on an existing district energy plant shall be used to derive energy performance. All input energy used to operate the district energy plant, and all output district heating or cooling delivered by the district thermal distribution system, shall be metered. All district energy plant monitoring equipment shall be in place for at least one full 12 month period. Metered energy performance figures shall be used for the proposed building performance model and shall be derived at a level of detail no longer than one month. The baseline building performance model shall be completed in accordance with the requirements outlined in Table C1.2.

2. District Energy System Modeling Path. Complete the requirements of the proposed and baseline building performance models defined in Table C1.2.

Table C1.2 Performance Modeling of District Energy System Requirements

<table>
<thead>
<tr>
<th>Proposed Building Performance</th>
<th>Baseline Building Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. District Cooling</td>
<td>Model on-site cooling plant or packaged cooling as defined in Standard 90.1, Normative Appendix G, Tables G3.1.1-3 and G3.1.1-4, using energy performance values from Standard 90.1, Normative Appendix G.</td>
</tr>
<tr>
<td>Model all cooling systems at the district energy plant, including energy conversion equipment and associated controls. Include all energy-using equipment, whether new or existing, that will impact the delivery of district cooling to the building project. Required systems include but are not limited to the following:</td>
<td></td>
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<tr>
<td>• Chillers</td>
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<td>• Make-up water pumping</td>
<td></td>
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<tr>
<td>• Primary pumping</td>
<td></td>
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<td>• Heat-rejection loop pumping</td>
<td></td>
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<tr>
<td>• Heat-rejection fans</td>
<td></td>
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<tr>
<td>• Water treatment and pressurization systems</td>
<td></td>
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<tr>
<td>• Heat exchanger losses</td>
<td></td>
</tr>
<tr>
<td>2. District Heating</td>
<td>Model on-site heating plant or packaged heating as defined in Standard 90.1, Normative Appendix G, Tables G3.1.1-3 and G3.1.1-4, using energy performance values from Standard 90.1, Normative Appendix G.</td>
</tr>
<tr>
<td>Model all heating systems at the district energy plant, including energy conversion equipment and associated controls. Include all energy-using equipment, whether new or existing, that will impact the delivery of district heating to the building project. Required systems include but are not limited to the following:</td>
<td></td>
</tr>
<tr>
<td>• Boilers</td>
<td></td>
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<tr>
<td>• Make-up water pumping</td>
<td></td>
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<tr>
<td>• Primary pumping</td>
<td></td>
</tr>
<tr>
<td>• Water treatment and pressurization equipment</td>
<td></td>
</tr>
<tr>
<td>• Heat exchanger losses</td>
<td></td>
</tr>
<tr>
<td>3. District Thermal Distribution System</td>
<td>Model thermal distribution systems in accordance with Standard 90.1, Normative Appendix G.</td>
</tr>
<tr>
<td>Model all equipment involved with the district thermal distribution system. Required systems include but are not limited to the following:</td>
<td></td>
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<tr>
<td>• Distribution and tertiary pumping</td>
<td></td>
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<tr>
<td>• Heat exchanger and thermal distribution losses</td>
<td></td>
</tr>
<tr>
<td>• Thermal distribution losses from leakage or nonreturn of distribution medium</td>
<td></td>
</tr>
</tbody>
</table>
4. Combined Heat and Power Systems

Model combined heat and power systems using the following methodology.

Allocate electricity to the building project as a fraction of the total electricity output of the district energy system, where the fraction is the thermal energy provided to the building project divided by the total thermal energy output of the district energy system.

Use Equation C-1 to determine the amount of electricity generated from the CHP system to be applied to the building project. Alternatively, use Equation C-2 if the CHP system includes cooling generation from recovered heat or if there is an additional waste heat recovery stream Z\(_{OTHER}\) (e.g., a CHP system could extract steam and hot water on two separate loops).

\[
\text{CHP\_ELEC\_BLDG} = (X_{\text{HEAT}} \times \text{BLDG\_HEAT}) \times \text{CHP\_ELEC\_TOTAL} \quad (C-1)
\]

\[
\text{CHP\_ELEC\_BLDG} = \left( (X_{\text{HEAT}} \times \text{BLDG\_HEAT}) + (Y_{\text{CHW}} \times \text{BLDG\_CHW}) + (Z_{\text{OTHER}} \times \text{BLDG\_OTHER}) \right) \times \text{CHP\_ELEC\_TOTAL} \quad (C-2)
\]

where

- \(\text{CHP\_ELEC\_BLDG}\) = CHP electricity generation allocated to the building
- \(X_{\text{HEAT}}\) = fraction of the CHP plant’s total production of waste heat applied to the DES
- \(\text{BLDG\_HEAT}\) = fraction of total district heat provided to the building
- \(\text{CHP\_ELEC\_TOTAL}\) = total CHP electricity generated at the DES plant
- \(Y_{\text{CHW}}\) = fraction of the CHP system’s total production of waste heat applied to producing chilled water in the DES
- \(\text{BLDG\_CHW}\) = fraction of total district chilled water provided to the building
- \(Z_{\text{OTHER}}\) = fraction of the CHP system’s total production of waste heat applied to an additional form of district energy
- \(\text{BLDG\_OTHER}\) = fraction of an additional form of district energy that is provided to the building

5. Utility Tariffs

Utility tariffs shall reflect the rates used on the building project, determined in accordance with Standard 90.1, Section G2.4.2.

Same as proposed design.

6. Carbon Dioxide Equivalent Emissions Factors

Carbon dioxide equivalent emission factors shall be applied to the energy supplied to the district energy system and reflect the values used in Table 7.5.2B, and shall be applied uniformly for all building project and district energy systems.

Same as proposed design.
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.