

Public Review Draft

Proposed Addendum bm to Standard 189.1-2017

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

Third Public Review (January 2019)
(Draft Shows Proposed Independent Substantive
Changes to Previous Public Review Draft)

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FOREWORD

Addendum bm adds the option under the energy performance path in Standard 189.1 of modeling district energy systems that are not wholly contained within the project site boundary. This independent substantive change to the addendum makes changes to the language intended to improve clarity and correct some errors contained in the 2nd public review ISC version.

Note: This public review draft makes proposed independent substantive changes to the previous public review draft. These changes are indicated in the text by underlining (for additions) and strikethrough (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the previous draft are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed substantive changes.

Addendum bm to Standard 189.1-2017

Modify Section 3 as follows:

3.2 Definitions

combined heat and power system (CHP): an on-site or off-site district energy conversion plant that delivers both electricity and thermal energy, where a portion or all of the thermal energy serves the building project.

district energy plant: a centralized cooling ~~and/or~~ heating plant (e.g. centralized chiller or boiler plant) which distributes ~~district thermal utilities~~ heating or cooling to multiple buildings and loads, one of which being the building project-site.

district energy system (DES): a ~~district~~ thermal energy system made up of one or more district energy plants and a district thermal distribution system.

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district-thermal-utilities heating or cooling: heat transfer media such as chilled water, hot water or steam produced by a ~~district energy plant~~ district energy plant and transported via a district thermal distribution system.

district thermal distribution system: a system for transporting ~~district thermal-utilities-heating or cooling~~ from a district energy plant to the building project site. The system includes all energy consuming equipment involved with transport including pumps, heat exchangers, water treatment, thermal losses and pressure control.

Modify Section 7.5 as follows:

7.5 Performance Option

7.5.1 Annual Energy Cost. The *proposed building performance* cost index with consideration of renewables shall be calculated in accordance with ANSI/ASHRAE/IES Standard 90.1, Normative Appendix G, and be equal to or less than the Performance Cost Index (PCI) Target, as determined from the following equation:

$$PCI_t = \frac{BBUEC + (BBREC \times BPF) - REC}{BBUEC + BBREC}$$
$$PCI_{target} PCI_t = \frac{BBUEC + (BBREC \times BPF) - REC}{BBUEC + BBREC}$$

where

- $PCI_{target} PCI_t$ = target PCI required for achieving compliance with the standard, unitless.
- BBUEC = the component of *baseline building performance* that is due to *unregulated energy use*, \$
- BBREC = the component of *baseline building performance* that is due to *regulated energy use*, or *baseline building performance* minus BBUEC, \$
- BPF = building performance factor taken from Table 7.5.2A, unitless
- REC = renewable energy production determined from Section 7.4.1.1.1 and converted to cost, \$

The proposed building PCI, without consideration of renewables, shall comply with the requirements of ANSI/ASHRAE/IES 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

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part by a district ~~thermal utilities~~ 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 ~~thermal utilities~~ 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 follows:

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 ~~thermal utilities~~ energy plant shall comply with either Section C1.3.1 or C1.3.2.

C1.3.1 Modeling Purchased ~~District Thermal Utilities Heating or Cooling~~. The *proposed building performance* and *baseline building performance* shall be calculated using the cost of purchased district ~~thermal utilities~~ 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. CO₂e emission factors in Table 7.5.2B for district ~~thermal utilities~~ 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 ~~thermal utilities~~ 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 performance* shall not exceed the *baseline building performance* using the requirements of comply with Standard 90.1 using the Performance Rating Method. Section 4.2.1 for regulated energy use.

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- b. Model the *district ~~thermal utilities~~ 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 demand from the *building project site* 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 ~~exceptional calculation methods~~ requirements defined in Standard 90.1, Section G2.5, Exceptional Calculation Methods. Projects shall comply with either Section C1.3.2(b)i or C1.3.2(b)ii.
 - i. **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 energy~~ district heating and cooling delivered by the *district thermal distribution system* shall be metered. All ~~district energy plant~~ 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.
 - ii. **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

| <i>Proposed Building Performance</i> | <i>Baseline Building Performance</i> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1. District Cooling</p> <p>Model all cooling systems at the <i>district energy plant</i> including energy conversion equipment and associated controls. Include all energy-using equipment, whether new or existing, that will impact the delivery of <i>district thermal utilities cooling</i> to the <i>building project building site</i>. Required systems include <u>but are not limited to</u>:</p> <ul style="list-style-type: none"> • Chillers • Make-up water pumping • Primary pumping • Heat rejection loop pumping • Heat rejection fans • Water treatment and pressurization systems • Heat exchanger losses | <p>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.</p> |

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2. District Heating

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 thermal utilities-heating* to the *building project-building site*. Required systems include but are not limited to:

- Boilers
- Make-up water pumping
- Primary pumping
- Water treatment and pressurization equipment
- Heat exchanger losses

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.

3. District Thermal ~~Utilities~~ Distribution System

Model all ~~thermal distribution~~ equipment involved with the *district thermal distribution system* transporting a thermal energy medium to the *project building site*. Required systems include but are not limited to:

- Distribution and tertiary pumping
- Heat exchanger and thermal distribution losses
- Thermal distribution losses from leakage or non-return of distribution medium

Model thermal distribution systems in accordance with Standard 90.1 Normative Appendix G.

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4. Combined Heat and Power Systems

Do not model CHP.

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*.

~~Allocate the electricity generation from the CHP system to the *building project* site in proportion to the fraction of thermal loads to the building for the *district energy system* sources that use recovered waste heat. For each *district energy system* supplying the *building project* site, determine the fraction of the recovered waste heat applied to that source as well as the amount serving the *building project* site.~~

Use equation C-1 to determine the amount of electricity generated from the CHP system to be applied to the *building project* site. 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).

$$\begin{aligned} \mathbf{CHP_ELEC}_{BLDG} &= (\mathbf{X}_{HEAT} * \mathbf{BLDG}_{HEAT}) \\ & * \mathbf{CHP_ELEC}_{TOTAL} \end{aligned} \quad (C-1)$$

$$\begin{aligned} \mathbf{CHP_ELEC}_{BLDG} &= [(\mathbf{X}_{HEAT} * \mathbf{BLDG}_{HEAT}) \\ & + (\mathbf{Y}_{CHW} * \mathbf{BLDG}_{CHW}) \\ & \pm (\mathbf{Z}_{OTHER} * \mathbf{BLDG}_{OTHER})] \\ & * \mathbf{CHP_ELEC}_{TOTAL} \end{aligned} \quad (C-2)$$

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CHP_ELEC_{BLDG} = The CHP electricity generation allocated to the building

X_{HEAT} = The fraction of the CHP plant's total production of waste heat applied to the DES directly

$BLDG_{HEAT}$ = The fraction of total district heat provided to the building

CHP_ELEC_{TOTAL} = The total CHP electricity generated at the DES plant

$$\frac{CHP_ELEC_{BLDG}}{CHP_ELEC_{TOTAL}} = \left[\frac{(X_{HEAT} * BLDG_{HEAT}) + (Y_{CHW} * BLDG_{CHW}) + (Z_{SOURCE} * BLDG_{SOURCE})}{CHP_ELEC_{TOTAL}} \right] \quad (C-2)$$

~~**CHP_ELEC_{BLDG}**~~ = (same as C-1 for simple case)

~~**X_{HEAT}**~~ = (same as C-1 for simple case)

~~**$BLDG_{HEAT}$**~~ = (same as C-1 for simple case)

Y_{CHW} = The fraction of the CHP system's total production of waste heat applied to producing chilled water in the DES

$BLDG_{CHW}$ = The fraction of total district chilled water provided to the building

$Z_{SOURCEOTHER}$ = The fraction of the CHP system's total production of waste heat applied to the 3rd an additional form of district energy source

$BLDG_{SOURCEOTHER}$ = The fraction of the 3rd district energy source an additional form of district energy that is provided to the building

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~~CHP_ELEC~~_{TOTAL} = (same as C-1 for simple case)

5. Utility Tariffs

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

Same as *proposed design*.

6. Carbon Dioxide Equivalent Emission Factors

Carbon dioxide equivalent emission factors shall be applied to the energy supplied to the district energy system, 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*.