DENVER AMENDMENT PROPOSAL FORM
FOR PROPOSALS TO THE 2019 DENVER BUILDING CODE AMENDMENTS AND THE 2021 INTERNATIONAL CODES

2021 CODE DEVELOPMENT CYCLE

1) Name: Courtney Anderson
   Email: Courtney.Anderson@denvergov.org
   Date: 10/12/2021
   Representing (organization or self): City Staff Proposal (check box): ☒

2) One proposal per this document is to be provided with clear and concise information.
   Is a separate graphic file provided ( "X" to answer): ___ Yes or No

3) Highlight the code and acronym that applies to the proposal

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Code Name</th>
<th>Acronym</th>
<th>Code Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBC</td>
<td>International Building Code</td>
<td>IRC</td>
<td>International Residential Code</td>
</tr>
<tr>
<td>IEBC</td>
<td>International Existing Building Code</td>
<td>IMC</td>
<td>International Mechanical Code</td>
</tr>
<tr>
<td>IFC</td>
<td>International Fire Code</td>
<td>DGC</td>
<td>Denver Green Code</td>
</tr>
</tbody>
</table>

AMENDMENT PROPOSAL

Please provide all the following items in your amendment proposal.

| Code Sections/Tables/Figures Proposed for Revision: |
| Instructions: If the proposal is for a new section, indicate (new), otherwise enter applicable code section. |
| C407.4 |

| Proposal: |
| Instructions: Show the proposal using **strikeout**, _underline_ format. |

Place an “X” next to the choice that best defines your proposal: _X_ Revision _X_New Text __Delete/Substitute __Deletion

Add the following sections and renumber the following equations:

Add the following section:

**C407.1 Scope.** This section establishes criteria for demonstrating compliance with Appendix G of ANSI/ASHRAE/IESNA 90.1. *Buildings demonstrating compliance with this section shall comply with Section C407.2 and either Section C407.3 or Section C407.4.*

Add the following table:

<table>
<thead>
<tr>
<th>Building Type</th>
<th>DTA</th>
<th>ECBP</th>
<th>SEBPF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apartment (R-2)</td>
<td>0.81</td>
<td>0.73</td>
<td>0.636</td>
</tr>
<tr>
<td>Up to 7 stories</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apartment (R-2)</td>
<td>0.84</td>
<td>0.73</td>
<td>0.636</td>
</tr>
</tbody>
</table>
8 or more stories
Small Hotel (R-1)
Up to 100,000 sf
Large Hotel (R-1)
100,000 sf and larger
Healthcare/Hospital
Small and Medium Office
(Group B)
Up to 100,000 sf
Large Office (Group B)
100,000 sf and larger
Restaurant
Retail (Group M)
School (Group E)
Warehouse (Group S)
All Other
0.84 0.51 0.458
0.87 0.51 0.458
0.84 0.52 0.506
0.86 0.51 0.497
0.82 0.51 0.497
0.84 0.60 0.602
0.83 0.54 0.540
0.84 0.40 0.436
0.82 0.47 0.529
0.84 0.51 0.527

Add the following:

**C407.4 Compliance based on site energy.** Buildings complying with Appendix G of ANSI/ASHRAE/IESNA 90.1 based on site energy shall comply with this section.

**C407.4.1 Modifications to Appendix G.** For the purposes of compliance with Section C407.4, Appendix G of ANSI/ASHRAE/IESNA 90.1 shall be modified as follows:

**C407.4.1.1 Section G1.2.2.** Section G1.2.2 shall not be used. Site Energy Performance Index (SEPI) is calculated in accordance with the following formula:

\[
\text{Site Energy Performance Index} = \frac{\text{Proposed design site energy}}{\text{Baseline building design site energy}}
\]

Both the proposed design site energy and the baseline building design site energy shall include all end-use load components within and associated with the building when calculating the Site Energy Performance Index.

**C407.4.1.2 Terms.** All references to “proposed building performance” shall be replaced with “proposed design site energy.” All references to “baseline building performance” shall be replaced with “baseline building design site energy.”

**C407.4.2 Compliance.** Buildings shall comply with the provisions of Appendix G of ANSI/ASHRAE/IESNA 90.1, “Performance Rating Method.” The Site Energy Performance Index (SEPI) shall be less than or equal to the Site Energy Performance Index Target (SEPI\textsubscript{T}) when calculated in accordance with the following:

\[
\text{SEPI} = \frac{\text{DTA} \times \left[ \text{BBUSE} + (\text{SEBPF} \times \text{BBRSE}) \right]}{\text{BBDSE}}
\]

where

- SEPI\textsubscript{T} = Performance Site Energy Index calculated in accordance with Section C407.4.1.1.
- DTA = Denver Target Adjustment from Table C407.3. For building area types not listed in Table C407.3 use “All others.” Where a building has multiple
building area types, the DTA shall be equal to the area-weighted average of the building area types.

\[
BBUSE = \text{Baseline Building Unregulated Site Energy, the portion of the annual site energy of a baseline building design that is due to unregulated energy use.}
\]

\[
BBRSE = \text{Baseline Building Regulated Site Energy, the portion of the annual site energy of a baseline building design that is due to regulated energy use.}
\]

\[
SEBPB = \text{Site Energy Building Performance Factor from Table C407.3. For building area types not listed in Table C407.3 use “All others.” Where a building has multiple building area types, the required SEBPF shall be equal to the area-weighted average of the building area types.}
\]

\[
BBDSE = \text{Baseline Building Design Site Energy}
\]

Regulated site energy shall be calculated by multiplying the total site energy by the ratio of regulated energy use to total energy use for each fuel type. Unregulated site energy shall be calculated by subtracting regulated site energy from total site energy.

DGC Revisions:

701.(7.5) Performance Approach (Project Elective). IECC, Section C401.2, option 3 shall not be used. Buildings shall comply with IECC, Section C401.2, option 1(c) with the following modifications.

1.(7.5.1) Annual Energy Cost. The Energy Cost Budget option IECC, Section C401.2, option 1(c)(1) shall not be used.

(7.5.2) Annual Site Energy. Buildings shall comply with the site energy index target (SEIt), applying the building performance factor from the ASHRAE 90.1 Performance Rating Method.

the Site Energy Index Target (SEIt) shall be calculated in accordance with the following:

\[
SEIt = 0.77 \times \left[ BBUSE + (BPF \times BBRSE) \right] / BBP
\]
### Supporting Information (Required):
All proposals must include a written explanation and justification as to how they address physical, environmental, and/or customary characteristics that are specific to the City and County of Denver. The following questions must be answered for a proposal to be considered.

**Purpose:** What does your proposal achieve?

This proposal adds an option to use site energy as the energy metric in the modeling compliance path of ASHRAE 90.1 Appendix G to support the electrification of projects.

**Reason:** Why is your proposal necessary?

“Denver’s Net Zero Energy (NZE) New Buildings & Homes Implementation Plan” includes a goal to transition new Denver buildings to all-electric design. However, ASHRAE 90.1 Appendix G uses energy cost as the energy metric for modeling. Due to very inexpensive costs for natural gas in Denver, this creates a significant barrier to electrification for Denver projects that pursue modeled performance-based code compliance. The inexpensive gas disadvantages electric equipment, effectively making it harder to comply with the code with electric equipment, even when that equipment is significantly more efficient that their gas counterparts.

The 2019 Denver Energy Code partially addressed this issue by including a source energy-based option for modeling developed by the Pacific Northwest National Lab. This limited the advantage of natural gas but did not eliminate it. At the time, site energy options were not available because there was not a site energy approach for the new modeling method in 90.1-2016. For the 2021 DEC, PNNL has been able to develop a set of site energy-based building performance factors (BPFs) that can be used with Appendix G. Utilizing site energy eliminates the substantial advantage inexpensive gas gives gas equipment in Denver projects.

**Substantiation:** Why is your proposal valid? (i.e. technical justification)

This proposal adds an additional option for using site energy in Appendix G. It is an option, so the energy cost metric is still available. The equations and BPFs are added to the new Section C407 that is being proposed for the DEC to modify 90.1 Appendix G for use in Denver.

In order to minimize the changes required to Appendix G to convert energy cost terminology to site energy terminology, the proposal uses a terminology management method already used in Appendix G. Appendix G has a provision that states that when Appendix G is used for code compliance, all instances of “rating authority” shall be replaced with code official. This proposal does a similar thing by stating that all references to “proposed building performance” shall be replaced with “proposed design site energy” and all references to “baseline building performance” shall be replaced with “baseline building design site energy.”

The Performance Cost Index (PCI) calculation utilized for Appendix G assumes energy cost in the terminology. Therefore, this proposal also creates a new equation and set of equations for calculating a performance target that is based on site energy terminology.

**Bibliography and Access to Materials** (as needed when substantiating material is associated with the amendment proposal):

None

### Other Regulations Proposed to be Affected

*For proposals to delete content from the 2019 Denver Green Code in conjunction with adding it to other mandatory Denver codes and/or regulations, only.*

Please identify which other mandatory codes or regulations are suggested to be updated (if any) to accept relocated content.

None

### Referenced Standards

List any new referenced standards that are proposed to be referenced in the code.

None

### Impact:

How will this proposal impact cost and restrictiveness of code? ("X" answer for each item below)

The proposal will decrease the cost of design and construction by providing greater flexibility. The proposal will specifically reduce the cost of compliance for all-electric buildings by removing the advantage given in the standard energy cost method.

4/14/21
<table>
<thead>
<tr>
<th>Cost of construction:</th>
<th>___ Increase</th>
<th>___ Decrease</th>
<th>___ No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of design:</td>
<td>___ Increase</td>
<td>___ Decrease</td>
<td>___ No Impact</td>
</tr>
<tr>
<td>Restrictiveness:</td>
<td>___ Increase</td>
<td>___ Decrease</td>
<td>___ No Impact</td>
</tr>
</tbody>
</table>

**Departmental Impact (City use only):**
This amendment proposal increases/decreases/is neutral to the cost of plans review.
This amendment increases/decreases/is neutral to the cost of inspections.