Code Amendment Proposal Form
For public amendments proposed to the 2018 editions of the International Codes

Instructions: Upload this form and all accompanying documentation at www.denvergov.org/BuildingCode. If you are submitting your proposal on a separate sheet, make sure it includes all information requested below.

All proposals must be received by April 26, 2019.

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CONTACT INFORMATION

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Organization: New Buildings Institute

I, Sean Denniston, hereby grant and assign to City and County of Denver all rights in copyright I may have in any authorship contributions I make to City and County of Denver in connection with this proposal. I understand that I will have no rights in any City and County of Denver publications that use such contributions in the form submitted by me or another similar form and certify that such contributions are not protected by the copyright of any other person or entity.

Signature: [Signature]

Co-proposed by: Amber Wood, Denver Department of Public Health and Environment
Jim Meyers, Southwest Energy Efficiency Project

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AMENDMENT PROPOSAL

Please use a separate form for each proposal.

1) Code(s) associated with this proposal. Please use acronym: IECC

If you submitted a separate coordination change to another code, please indicate which code: ________________________

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Code Name</th>
<th>Acronym</th>
<th>Code Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>DBC-xxxx</td>
<td>Denver Building Code–xxxx (code) amendments (e.g., DBC-IBC, DBC-IEBC)</td>
<td>IFGC</td>
<td>International Fuel Gas Code</td>
</tr>
<tr>
<td>IEBC</td>
<td>International Existing Building Code</td>
<td>IMC</td>
<td>International Mechanical Code</td>
</tr>
<tr>
<td>IECC</td>
<td>International Energy Conservation Code</td>
<td>IPC</td>
<td>International Plumbing Code</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IRC</td>
<td>International Residential Code</td>
</tr>
</tbody>
</table>

2) Please check here if a separate graphic file is provided: ☐

Graphics may also be embedded within your proposal below.

3) Use this template to submit your proposal or attach a separate file, but please include all items requested below in your proposal. The only formatting needed is BOLDING, STRIKEOUT AND UNDERLINING. Please do not provide additional formatting such as tabs, columns, etc., as this will be done by CPD.
Proposal:

Revise the section as follows:

R401.2 Compliance. Projects shall comply with Appendix RA and one of the following:

1. Sections R401 through R404 and Section 407.
2. Section R405 and the provisions of Sections R401 through R404 indicated as “Mandatory.”
3. The energy rating index (ERI) approach in Section R406.

R401.2.1 Tropical zone. Residential buildings in the tropical zone at elevations less than 2,400 feet (731.5 m) above sea level shall be deemed to be in compliance with this chapter provided that the following conditions are met:

- Not more than one half of the occupied space is air conditioned.
- The occupied space is not heated.
- Solar, wind or other renewable energy source supplies not less than 80 percent of the energy for service water heating.
- Glazing in conditioned spaces has a solar heat gain coefficient of less than or equal to 0.40, or has an overhang with a projection factor equal to or greater than 0.30.
- Permanently installed lighting is in accordance with Section R404.
- The exterior roof surface complies with one of the options in Table C402.3 or the roof or ceiling has insulation with an R value of R-15 or greater. Where attics are present, attics above the insulation are vented and attics below the insulation are unvented.
- Roof surfaces have a slope of not less than one-fourth unit vertical in 12 units horizontal (21 percent slope). The finished roof does not have water accumulation areas.
- Operable fenestration provides a ventilation area of not less than 14 percent of the floor area in each room. Alternatively, equivalent ventilation is provided by a ventilation fan.
- Bedrooms with exterior walls facing two different directions have operable fenestration on exterior walls facing two directions.
- Interior doors to bedrooms are capable of being secured in the open position.
- A ceiling fan or ceiling fan rough-in is provided for bedrooms and the largest space that is not used as a bedroom.

Add new Section 407 as follows:

R407 FLEX POINTS FOR ADDITIONAL ENERGY EFFICIENCY

R407.1 Scope This section establishes flex point alternatives to achieve additional energy efficiency in accordance with Section R401.2.

R407.2 Flex points for additional energy efficiency. The building shall achieve 5 points in accordance with Table R407.2. Each measure chosen shall receive credit for the Flex Points as indicated in the Table. Interpolation of points between measures shall not be permitted.
## TABLE R407.2

FLEX POINTS FOR ADDITIONAL ENERGY EFFICIENCY

<table>
<thead>
<tr>
<th>Measure Number</th>
<th>Measure Description</th>
<th>Flex Point Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>≥ 2.5% reduction in total UA&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2</td>
</tr>
<tr>
<td>1b</td>
<td>≥ 5% reduction in total UA&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4</td>
</tr>
<tr>
<td>1c</td>
<td>≥ 7.5% reduction in total UA&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6</td>
</tr>
<tr>
<td>2a</td>
<td>≥ 10% reduction in glazed vertical fenestration area-weighted average SHGC&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1</td>
</tr>
<tr>
<td>2b</td>
<td>≥ 20% reduction in glazed vertical fenestration area-weighted average SHGC&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2</td>
</tr>
<tr>
<td>3a</td>
<td>≤ 3 ACH50 air leakage rate with ERV or HRV installed&lt;sup&gt;g&lt;/sup&gt;</td>
<td>7</td>
</tr>
<tr>
<td>3b</td>
<td>≤ 2 ACH50 air leakage rate with ERV or HRV installed&lt;sup&gt;g&lt;/sup&gt;</td>
<td>9</td>
</tr>
<tr>
<td>4a</td>
<td>≤ 2 CFM of total duct leakage per 100 square feet of conditioned floor area when tested in accordance with Section R403.3</td>
<td>1</td>
</tr>
<tr>
<td>4c</td>
<td>100% of ductless thermal distribution system or hydronic thermal distribution system located completely inside the building thermal envelope or 100% of duct thermal distribution system located in conditioned space&lt;sup&gt;a&lt;/sup&gt;</td>
<td>12</td>
</tr>
<tr>
<td>5a</td>
<td>≥ 18 SEER and ≥ 14 EER cooling system efficiency&lt;sup&gt;d&lt;/sup&gt;</td>
<td>3</td>
</tr>
<tr>
<td>5b</td>
<td>≥ 16 EER cooling system efficiency&lt;sup&gt;d&lt;/sup&gt;</td>
<td>3</td>
</tr>
<tr>
<td>6a</td>
<td>≥ 96 AFUE heating system efficiency&lt;sup&gt;e&lt;/sup&gt;</td>
<td>10</td>
</tr>
<tr>
<td>6c</td>
<td>10.5 HSPF heating system efficiency&lt;sup&gt;e&lt;/sup&gt;</td>
<td>5</td>
</tr>
<tr>
<td>7a</td>
<td>≥ 3.5 COP heating system efficiency&lt;sup&gt;e&lt;/sup&gt;</td>
<td>8</td>
</tr>
<tr>
<td>7b</td>
<td>≥ 0.8 EF for fossil fuel service water heating system</td>
<td>2</td>
</tr>
<tr>
<td>8a</td>
<td>≥ 3.0 EF for electric service water heating system</td>
<td>9</td>
</tr>
<tr>
<td>8c</td>
<td>≥ 0.4 Solar Fraction for service water heating system</td>
<td>6</td>
</tr>
</tbody>
</table>

- **a.** The Total UA shall be calculated in accordance with Section R402.1.5 Total UA alternative.
- **b.** Minimum Heat Recovery Ventilator (HRV) and Energy Recovery Ventilator (ERV) requirements, measured at the lowest tested net supply airflow, shall be ≥ 75% Sensible Recovery Efficiency (SRE), ≤ 1.1 W/CFM Fan Energy and shall not use recirculation as a defrost strategy. In addition, the Energy Recovery Ventilator (ERV) shall be ≥ 50% Latent Recovery/Moisture Transfer (LRMT).
- **c.** As defined by Section R403.3.7.
- **d.** For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in Table R407.2 and shall be sized to serve 100% of the cooling design load. As an alternative, each system installed shall receive credit for the percentage of the Flex Points for the measure equal to the percentage of the cooling design load served by the system.
- **e.** For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in Table R407.2 and shall be sized to serve 100% of the heating design load. As an alternative, each system installed shall receive credit for the percentage of the Flex Points for the measure equal to the percentage of the heating design load served by the system.

### Supporting Information:

#### Purpose:
The purpose of this proposal is to add a flexible means of significantly increasing the stringency of the energy code in order to meet Denver’s energy code goals

#### Reason:
Denver’s aggressive goals for its energy code will require a significant advancement in the prescriptive path. This proposal creates a way to meet those goals while maintaining flexibility for projects. It leverages the optional packages method already used in the commercial code as the means.

The Northwest pioneered the use of the prescriptive residential options that are currently in place in Washington, and formally were used in Oregon, and found them to be an effective method of increasing efficiency for residential construction using the prescriptive approach. This option does not require performance energy modeling or HERS verification which will increase its usefulness. This type of points-based option can also be easily implemented in the U.S. DOE REScheck software or with a simple side checklist. This approach is also similar in structure to the Points Option code change proposal that has been submitted by to C407 in the commercial provisions of the 2018 IECC.

The purpose of this code change proposal is to improve overall residential building efficiency (heating, cooling and water heating energy) and to create a scalable, flexible means of improving residential building efficiency for future IECC updates. Instead of requiring efficiency improvements to specific building components, the new “Flex Points” approach in Section R407 provides a multitude of options for builders to achieve the efficiency requirements of the IECC. This approach is also scalable according to Denver’s future code advancement needs. Package- or points-based approaches have been used for several years in Washington and Oregon.

This Flex Points proposal is cost-effective, since it includes a number of options to achieve points that are cost- effective.

The Flex Points proposal will provide three distinct benefits for jurisdictions adopting the 2021 IECC:

1. **This proposal will provide maximum flexibility for builders to achieve improved efficiency.**
   
   Flex Points trusts that builders and design professionals will select the most cost-effective and sensible efficiency improvements for a given project. There are several alternatives for compliance with options to comply in a performance- or rating-based path. There are alternatives related to more insulation, more efficient windows, reduced air and duct leakage and improved equipment. We believe that this approach provides the right incentives for builders to make long-lasting improvements in residential buildings that are in the best interests of homeowners.

   The point values have been calculated based on the present value of energy cost savings over the current code (including relevant federal equipment efficiency standards) and reflect the estimated useful life of each measure over an assumed 30-year life of the building. While a 30-year period is consistent with the typical life of a mortgage, it is a very conservative period given the likelihood that some measures will provide efficiency benefits for decades beyond the initial 30-year period.

   The analysis behind the flex points is based on the methodology and assumptions included in the U.S. Department of Energy’s Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes, including the economic equations to obtain the present value of energy costs within the calculation methodology. The energy consumption calculations take into consideration heating, cooling, and water heating energy, using DOE-2 energy simulation across 105 TMY3 weather locations and 12 building types to account for varying stories, foundations, and fuel types for each of the baseline and upgrade measures. The analysis compares the annual energy savings between a home with and without an efficiency measure over the useful life of the efficiency measure using useful life data from NAHB and other sources. Energy costs were calculated using the most recent national EIA projections for natural gas and electricity. Because the analysis uses readily-available and widely-accepted tools and methodologies, we expect that future additions or changes will be straightforward.

2. **This proposal will encourage efficiency improvements in building components that are currently difficult to regulate.**
   
   Flex Points addresses two issues that have complicated model energy codes for many years. First, innovative building practices or emerging technologies can benefit from being listed in codes, but states (and national code developing organizations) are reluctant to require new technologies or practices before they are market-tested. As a result, there are high barriers to entry for new technologies, even when they could transform the marketplace and provide energy- or cost-saving benefits for homeowners. As an example, Heat Recovery Ventilators (HRVs) are cost-effective and reasonable for much of the country, but individual circumstances or climate conditions may favor another approach. Rather than require HRVs in every case, or most cases with exceptions, HRVs and Energy Recovery Ventilators are included as one of several options available to builders in every climate zone. Not only will Flex Points create an opportunity for good technology to be used in more buildings, but it will open the door for
market forces to make these technologies more widely available (and presumably less expensive to consumers). As new technologies or practices become available, these advances can be quickly and easily added into the Flex Points table, fast-tracking technology that is good for consumers.

Second, much of the heating, cooling, and water heating equipment installed in residential buildings is subject to federal preemption under the National Appliance Energy Conservation Act. As has been debated at length in ICC Code Development hearings over the last 15 years, including equipment efficiencies in performance trade-offs tends to weaken the efficiency of the energy code, since federal minimum efficiencies for nearly every covered product is well below the efficiency levels of commonly installed products. When these efficiency levels are used in trade-off baselines, builders use the improved efficiency of common heating, cooling, and water heating products as a means of trading away efficiency of more permanent building components and features, even though the equipment would have been installed anyway. This “free ridership” may provide short-term cost savings for homebuilders, but it saddles homeowners with unexpected high energy costs over the entire useful life of the building. Moreover, this equipment often carries a much shorter useful life, which is not typically captured in code compliance simulations.

Flex Points creates a new incentive to improve the efficiency of covered products without resulting in efficiency rollbacks elsewhere in the code. Heating, cooling, and water heating improvements (among others) are included among the Flex Points options with points calculated according to climate-specific energy cost savings and the longevity of the equipment. As compared to the previous Flex Points proposal, the list of options has been simplified and refocused on the equipment most likely to provide meaningful energy savings. Each of these upgrades will build upon the current IECC efficiency, rather than trading it away.

This proposal is based on proposals submitted to the IECC-2021 by Energy Efficiency Codes Coalition (EECC) and the Northwest Energy Codes Group (the only substantial difference between those two proposals being the points target) and analysis conducted by the EECC. It also removes language from the IECC that is not necessary in Denver.

The number of points required by this proposal is 5, for 5% savings. In order for the next version of the energy code to stay “on the line” to make Denver’s 2035 goal, it will need to be 27% more efficient than the IECC-2018 (see below). This is a larger improvement than the commercial energy code since the residential code has not seen the same pace of advancement at the national level as the commercial code. All of the City of Denver’s other sponsored code proposals will deliver approximately 7% savings over IECC-2018. This proposal provides the framework to meet Denver’s energy code goals through increasing the number of points required in this proposal. If only the City-sponsored proposals are accepted, it would require 20 points in this proposal to meet Denver’s energy code goals.

<table>
<thead>
<tr>
<th>Referenced Standards:</th>
<th>NA</th>
</tr>
</thead>
</table>

**Impact:**

The effect of the proposal on the cost of construction: ☒ Increase □ Reduce □ No Effect
- The code change proposal will increase the cost of construction. Requiring additional efficiency measures, such as more insulation, more efficient windows, reduced air leakage and duct leakage, and/or more efficient equipment, to save 20% energy will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will continue to benefit consumers over the useful life of the home. Additionally, the flexibility of this approach allows for the most cost-effective means of meeting Denver’s aggressive code goals.

The effect of the proposal on the cost of design: ☒ Increase □ Reduce □ No Effect
- The proposal may require greater attention to the design process, especially in evaluating the options.

Is the proposal more or less restrictive than the I-codes: ☒ More □ Less □ Same

**Departmental Impact:** (To be filled out by CPD staff)

**Note:** CITY STAFF ONLY. Discuss the impact of this proposal in this section AND indicate the impact of this amendment proposal for each of the following:
- The effect of the proposal on the cost of review: □ Increase □ Reduce □ No Effect
- The effect of the proposal on the cost of enforcement/inspection: □ Increase □ Reduce □ No Effect