DENVER AMENDMENT PROPOSAL FORM
FOR CPD INTERNAL PROPOSALS TO THE 2016 DENVER BUILDING CODE AMENDMENTS AND THE 2018 INTERNATIONAL CODES

2018 CODE DEVELOPMENT CYCLE

1) Name: Robby Schwarz Date: 3/18/2019

2) Proposals should be drafted in Word with the only formatting that is needed being BOLDING, STRIKEOUT AND UNDERLINING. Please do not provide additional formatting such as tabs, columns, etc.

Please use a separate form for each proposal submitted.

Is separate graphic file provided (Yes or No):

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

Please provide all of the following items in your amendment proposal:

**Code Sections/Tables/Figures Proposed for Revision:**

NEW - Appendix RB

**Note:** If the proposal is for a new section, indicate (new).

November 15, 2005
Appendix RB

PATHWAY TO ZERO ENERGY RESIDENTIAL BUILDINGS, ENERGY RATING INDEX COMPLIANCE ALTERNATIVE

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

User Notes:
This appendix is offered as an optional pathway for jurisdictions to provide their community a stepped and phased approach to transition to a zero-energy code. It leverages the existing R406 Energy Rating Index Compliance Alternative pathway and an unamended RESNET/ANSI/ICC 301 Energy Rating Index standard as the means of measurement to determine compliance and success of achieving zero energy. This means that the HERS Energy Rating Index is the measurement tool for determining zero energy compliance. The phased implementation plan and dates will be determined at the time of adoption and at the discretion of the jurisdiction adopting this appendix which may shorten or elongated implementation.

RB101 Scope. These provisions shall be applicable for new residential buildings where zero energy provisions are required using an Energy Rating Index (ERI) analysis.

RB102 COMPLIANCE

Existing residential buildings shall comply with Chapter 5. New residential buildings shall comply with Section RB103.

RB103 ZERO ENERGY RESIDENTIAL BUILDINGS

RB103.1 General. New residential buildings shall comply with Section RB103.

RB103.2 Mandatory requirements. Compliance with this section requires that the provisions identified in Sections R401 through R404 indicated as “Mandatory” be met.

Exception: Supply and return ducts not completely inside the building thermal envelope shall be insulated to an R-value of not less than R-8.

RB103.3 Energy Rating Index. The Energy Rating Index (ERI) shall be determined in accordance with the most recent version of the RESNET/ANSI/ICC 301 standard.

Energy used to recharge or refuel a vehicle used for transportation on roads that are not on the building site shall not be included in the ERI reference design or the rated design.

RB103.4 ERI-based compliance.

Compliance based on an ERI analysis requires that the rated proposed design and confirmed built dwelling be shown to have a score less than or equal to the values in Table RB103.4., per the ERI implementation plan, when compared to the ERI reference design for each of the following conditions:

1. ERI value without on-site renewable energy generation, and
2. ERI value with on-site renewable energy generation

<table>
<thead>
<tr>
<th>TABLE RB103.4</th>
<th>MAXIMUM ENERGY RATING INDEX</th>
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<tbody>
<tr>
<td>ERI Implementation plan (phased implementation dates to be determined at the time of adoption)</td>
<td>ENERGY RATING INDEX WITHOUT ON-SITE RENEWABLES *</td>
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</table>

November 15, 2005
The maximum ERI without on-site renewables is fixed at an ERI of 40 at the 6th implementation phase, because thermal envelope and mechanical improvements cannot lower the ERI score significantly below an ERI of 40.

b. The Maximum ERI with on-site renewables can be achieved with or without installing on-site renewables until implementation phase 5 when on-site renewables are required to be used to lower the ERI below 40.

RB103.5 Verification by an approved agency. Verification of compliance with appendix RB as outlined in Section RB103.4 and RB103.6 shall be completed by an approved third party. Verification of Section RB103.5 shall be completed by the authority having jurisdiction or an approved third-party inspection agency per Section R105.4.

RB103.6 Documentation. Documentation of the software used to determine the ERI and the parameters for the residential building shall be in accordance with Sections RB103.6.1 through RB103.6.3.

RB103.6.1 Compliance software tools. Software tools used for determining ERI shall be Approved Software Rating Tools in accordance with ANSI/RESNET/ICC 301.

RB103.6.2 Compliance report. Compliance software tools shall generate a report that documents that the home and ERI score complies with Sections RB103.2 through Section RB103.4 The compliance documentation shall be created for the Proposed design and submitted with the application for the building permit. Confirmed compliance documents of the built dwelling unit shall be created and submitted to the code official for review before a certificate of occupancy is issued. Compliance reports shall include information in accordance with Sections.

RB103.6.2.1 Proposed Compliance report for permit application. Compliance reports submitted with the application for a building permit shall include the following:

1. Building street address, or other building site identification.
2. The name of the individual performing the analysis and generating the compliance report.
3. The name and version of the compliance software tool.
4. Documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
5. A certificate indicating that the proposed design has an ERI less than or equal to the appropriate scores indicated in Table R407.4 when compared to the ERI reference design. The certificate shall document the building component energy specifications that are included in the calculation including, component level insulation R-values or U-factors, assumed duct system and building envelope air leakage testing results, as well as the type and rated efficiencies of proposed heating, cooling, mechanical ventilation, and service water heating equipment to be installed. The type and production size of the proposed Onsite renewable Energy systems shall be reported.
6. When a site-specific report is not generated, the proposed design shall be based on the worst-case orientation and configuration of the rated home.
**RB103.6.2.2 Confirmed Compliance report for a certificate of occupancy.** A confirmed compliance report submitted for obtaining the certificate of occupancy shall be made site and address specific and include the following:

1. Building street address or other building site identification.
2. The name of the individual performing the analysis and generating the report.
3. The name and version of the compliance software tool.
4. Documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
5. A final confirmed certificate indicating that the confirmed rated design of the built home complies with Sections R407.2 and R407.4. The certificate shall report the energy features that were confirmed to be in the home including component level insulation R-values or U-factors, results from any required duct system and building envelope air leakage testing, as well as, the type and rated efficiencies of the heating, cooling, mechanical ventilation, and service water heating equipment installed. The type and production size of the confirmed Onsite renewable Energy systems shall be reported.

**RB103.6.3 Additional Documentation.** The code official shall be permitted to require the following Documents:

1. Documentation of the building component characteristics of the ERI reference design.
2. A certification signed by the builder providing the building component characteristics of the rated design.
3. Documentation of the actual values used in the software calculation for the rated design.

**RB103.6.4 Specific Approval.** Performance analysis tools meeting the applicable section of Appendix RB shall be approved. Documentation demonstrating the approval of the performance analysis with Section RB103.7.1 shall be provided.

**RB103.6.5 Input Values.** Where calculation require input values not specified by section R402, R403, R404 and R405, those input values shall be taken from RESNET/ICC 301.

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**Note:** Show the proposal using **strikeout**, **underline** format. At the beginning of each section, one of the following instruction lines are also needed:

- Revise as follows
- Add new text as follows
- Delete and substitute as follows
- Delete without substitution

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November 15, 2005
Supporting Information:

Purpose: To offer a flexible path forward to Zero Energy using the HERS ERI as a means provide a perdicatable path forward toward this goal.

Reason Statement

As the Energy Rating Index (ERI) diverges from the Home Energy Rating System Index (HERS) it becomes important to realize that although there are commonalities between the two, they are ultimately different from each other and should be thought of separately. As soon as the R406 ERI pathway was codified it locked in the ERI to a specific version of the RESNET/ANSI/ICC 301 standard while the HERS Index is based on a continually maintained version of the same ANSI 301 standard. Therefore, we now have divergent Index scores that mean different things.

The HERS Index benchmarks the efficiency of a home in comparison to a reference home that is based on the 2006 IECC. A HERS Rating is an asset rating of the energy features in a home. This means that in the process of a HERS Rating to generate the HERS Index a Rater does not necessarily inspect to see if energy features governed by the code are installed according to requirements of the code. For example, the HERS Ratings systems’ insulation installation grading criteria gives guidance on how to de-rate the R-value of poorly installed insulation. The Rater is required to give a grade 3 to poor installations. The HERS Index score is intended to evaluate the performance of what is installed. It is not intended to determine if it was installed per the requirement of code. A code rating or evaluation for the generation of the ERI score, on the other hand, should only use a grade 1 because only grade 1 installation of insulation meets the requirements of manufacturer instructions and therefore code. If a Rater were to evaluate a home for an ERI score and come across grade 3 installation of insulation, the installation should fail the inspection and be re-installed to meet code requirements. In this way, an ERI rating and a HERS rating are fundamentally different. One is held to a pass/fail requirement of code and the other is a quantification and evaluation of energy assets or components of the home. This small example demonstrates how the HERS index score and the ERI score differ.

Another example that demonstrates a more pronounced difference between the indices is the codified ventilation requirements for the ERI score vs. the ventilation requirements for the HERS Index score. The ERI score uses the ASHRAE 62.2-2010 ventilation requirements while the HERS Index uses the ASHRAE62.2-2013 ventilation requirements. This difference can result in over a 10-point difference in the scores.

Many are troubled by this divergence in the index scores, but I am not because the ERI and the HERS Index are fundamentally different if related systems. The HERS Index has been adopted by builders and the public primarily as a sales and marketing tool and a means to compare the performance of houses. The HERS Index score is quite good for these purposes. The ERI, like the area weighted u-values in section R402.1.5 Total U-factor Alternative, or cost comparison in section R405 Simulated Performance Alternative is a matrix by which a home’s performance can be compared to demonstrate compliance with the code. It is not intended for marketing or public consumption and as the scores continue to diverge the public will continue to be unaware of the ERI score just as they are unaware of area weighted u-values and cost compliance. If a common understanding can be created regarding this point then the ERI score can be a powerful tool to offer great flexibility for builders as well as a path forward for the code and municipalities who choose to use it to achieve greater energy efficiency.
This proposal has been designed to leverage the unique nature of the HERS Index and the already codified mandatory aspects of the IECC, so as to offer municipalities and builders an option that will continue the trend toward zero energy homes. As Appendix RB is an optional pathway municipalities and builders can choose a code compliance path that allows great flexibility in energy specifications and design while the homebuilding industry learns how to incorporate new technologies or better use old ones. The IECC’s emphasis on protecting the thermal envelope is protected not by a punitive R-value backstop, but rather by a before renewables Index score requirement. A Pre-renewables Index score opens up flexibility through cost-effective energy tradeoffs that are the most flexible for the builder as they would include mechanical, thermal or conductive, convective losses through envelope, along with duct tightness, lights, appliances, and more. Any feature that lowers the Index can be used. This integrated energy evaluation acknowledges that the HERS Index of a home cannot be lowered beyond a certain threshold unless renewables are installed, but also sets the pre-renewable Index score at a level that ensures current levels of efficiency will be created as the starting point. For example, when a builder maximizes the thermal envelope and mechanical efficiencies of their design the HERS Index cannot go lower than approximately 35-40. To get an Index score below that range on-site renewables must be installed. In this way, the appendix, as proposed, ensures a sound building envelope and efficient mechanical systems before renewables are considered.

The uniqueness of this proposal is that it creates a phased in timeline by which a clear incremental approach for achieving increases in efficiencies that would lead to zero energy homes can be achieved. Although this will be new to the code development world, it is tremendously important to allow the path to zero to be phased in and for giving builders and jurisdictions a timeline for planning to achieve the ultimate goal. This phased-in approach has precedence in two Colorado jurisdictions. The City of Boulder and Boulder County have both set a phased approach for attaining zero energy in their municipalities.

Appendix is optional so only those municipalities and builders that are searching for code compliant incremental approaches need take part. Denver may choose to make it mandatory if they like. It has become a difficult argument to increase R-values, house tightness or duct leakage requirements in the 2021 IECC development cycle. This Index score approach to Zero Energy offers a logical, market-driven approach that creates a timeline for achieving significant increases in efficiency while simultaneously giving industry time to adjust and provide cost-effective solutions. This proposal also guards against building poor thermal envelopes and offsetting with on-site renewable systems. This proposal offers builders the greatest flexibility to choose how to build to meet the requirements of code.

Cost Statement:
This PATHWAY TO ZERO ENERGY RESIDENTIAL BUILDINGS, ENERGY RATING INDEX COMPLIANCE ALTERNATIVE is just that and alternative pathway to not only demonstrate compliance with the IECC but to help jurisdictions that are interested define a measurable and incremental approach to create zero energy homes. This approach is being used in Colorado although it is true that cost of construction increases it is only required if the jurisdiction chooses to adopt the pathway.

Note: The following items are required to be included:
Purpose: The proponent shall clearly state the purpose of the proposed amendment to physical, environmental and customary characteristics that are specific to the City and County of Denver (e.g., clarify the Code; revise outdated material; substitute new or revised material for physical, environmental and customary characteristics; add new requirements to the Code; delete current requirements, etc.)
Reasons: The proponent shall justify changing the current Code provisions, stating why the proposal is necessary to reflect physical, environmental and customary characteristics that are specific to the City and County of Denver. Proposals that add or delete requirements
shall be supported by a logical explanation which clearly shows why the current does not reflect physical, environmental and customary characteristics that are specific to the City and County of Denver and explains how such proposals will improve the Code.

Substantiation: The proponent shall substantiate the proposed amendment based on technical information and substantiation. Substantiation provided which is reviewed and determined as not germane to the technical issues addressed in the proposed amendment shall be identified as such.

Bibliography (as needed): The proponent shall submit a bibliography when substantiating material is associated with the amendment proposal. The proponent shall make the substantiating materials available for review.

Referenced Standards:

Click or tap here to enter text.

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

Impact:

This is a predictable and flexible path to Zero that was also submitted to the ICC. The reason statement is from the ICC submittal. I change the reference to the HERS ERI from the 2018 ERI because of a current divergence of the two. The hope this will be resolved in the 2021 cycle

Cost Statement:

This R407 PATHWAY TO ZERO, ENERGY RATING INDEX COMPLIANCE ALTERNATIVE is just that and optional alternative path way to not only demonstrate compliance with the IECC but to help jurisdictions that are interested define a measurable and incremental approach to create zero energy homes. This approach is being used in Colorado although it is true that cost of construction increases it is only required if the jurisdiction chooses to adopt the pathway.

Note: The proponent shall indicate one of the following regarding the impact of the amendment proposal:

- The effect of the amendment proposal on the cost of construction; Increase, Reduce, No Effect:
- The effect of the amendment proposal on the cost of design; Increase, Reduce, No Effect:
- Is the amendment proposal more- or less-restrictive than the I-Codes; More, Less, Same:

Departmental Impact:

No effect

Note: Indicate one of the following regarding the impact of the amendment proposal:

- The effect of the amendment proposal on the cost of review; Increase, Reduce, No Effect:
- The effect of the amendment proposal on the cost of enforcement/inspection; Increase, Reduce, No Effect: