

1. For buildings complying with Section R401.2.1, one of the additional efficiency package options shall be installed according to Section R408.2.
2. For buildings complying with Section R401.2.2, the building shall meet one of the following:
 - 2.1. One of the additional efficiency package options in Section R408.2 shall be installed without including such measures in the proposed design under Section R405; or
 - 2.2. The proposed design of the building under Section R405.3 R405.2 #2 shall have an annual energy cost that is less than or equal to 95 percent of the annual energy cost of the standard reference Design.
- ~~3. For buildings complying with the Energy Rating Index Alternative Section R401.2.3, the Energy Rating Index value shall be at least 5 percent less than the Energy Rating Index target specified in Table R406.5. The option selected for compliance shall be identified in the certificate required by Section R401.3.~~

Revise as Follows

SECTION N1106 / R406

ENERGY RATING INDEX COMPLIANCE ALTERNATIVE

N1106.1 / R406.1 Scope. This section establishes criteria for compliance using an Energy Rating Index (ERI) analysis developed per ANSI/RESNET/ICC 301.

N1106.2 / R406.2 ERI compliance. Compliance based on the ERI requires that the rated design meets all of the following:

1. The requirements of the sections indicated within Table R406.2.
2. Maximum ERI values indicated in ~~of~~ Table R406.5 4.

TABLE N1106.2 / R406.2

REQUIREMENTS FOR ENERGY RATING INDEX

SECTION ^a	TITLE
General	
R401.2.5	Additional efficiency packages
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.3	Eave baffle
R402.2.4.1	Access hatches and doors
<u>R402.2.8.1</u>	<u>Basement Wall Insulation Installation</u>
<u>R402.2.9.1</u>	<u>Slab-on-grade floor insulation installation</u>
R402.2.10.1	Crawl space wall insulation installation
R402.4.1.1	Installation
R402.4.1.2	Testing
<u>R402.4.2</u>	<u>Fireplaces</u>
<u>R402.4.3</u>	<u>Fenestration air leakage</u>
<u>R402.4.4</u>	<u>Rooms containing fuel burning appliances</u>
R402.4.5	<u>Recessed lighting</u>
<u>R402.4.6</u>	<u>Electrical and communication outlet boxes (air Sealed boxes)</u>
Mechanical	
R403.1	Controls
R403.2	Hot water boiler

	<u>temperature reset</u>
R403.3 except Sections R403.3.2, R403.3.3 and R403.3.6	Ducts
R403.4	Mechanical system piping insulation
R403.5.1	Heated water calculation and temperature maintenance systems
R403.5.3	Drain water heat recovery units
R403.6	Mechanical ventilation
R403.7	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice systems
R403.10	Energy consumption of pools and spas
R403.11	Portable spas
R403.12	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
404.2	Interior lighting controls
R406.3	Building thermal envelope

R406.3 Building thermal envelope. Building and portions thereof shall comply with Section R406.3.1 or R406.3.2.

R406.3.1 On-site renewables are not included. Where on-site renewable energy is not included for compliance using the ERI analysis of Section R406.4, the proposed total building thermal envelope UA, which is sum of U factor times assembly area, shall be less than or equal to the building thermal envelope UA using the prescriptive U factors from Table R402.1.2 multiplied by 1.15 in accordance with Equation 4-1. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

$$UA_{\text{Proposed design}} = 1.15 \times UA_{\text{Prescriptive reference design}}$$

(Equation 4-1)

R406.3.2 On-site renewables are included. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 *International Energy Conservation Code*.

N1106.4.3 / R406.4.3 Energy Rating Index. The Energy Rating Index (ERI) shall be determined in accordance with the ANSI/RESNET/ICC 301 standard. Except for buildings covered by the *International Residential Code*, the ERI reference design ventilation rate shall be in accordance with Equation 4-2.

$$\text{Ventilation rate, CFM} = (0.01 \times \text{total square foot area of house}) + [7.5 \times (\text{number of bedrooms} + 1)]$$

(Equation 4-2)

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*. For compliance purposes, any reduction in energy use of the rated design associated with on-site renewable energy shall not exceed 5 percent of the total energy use.

N1106.5 4 / R406.5 4 ERI-based compliance. Compliance based on an ERI analysis requires that the *rated proposed design* and confirmed built dwelling be shown to have an ERI score ~~without and with on-site power production (OPP)~~ less than or equal to **the appropriate value indicated in Table N1106.4 / R406.5 4** when compared to the *ERI reference design*.

TABLE
N1106.5 4 / R406.5 4
MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE <i>All-Electric Properties</i>	ENERGY RATING INDEX <i>All Other Buildings</i>
0-1 55	52 50
2	52
3	51
4	54
5	55
6	54
7	53
8	53

N1106.5 / R406.6 5 Verification by approved agency. Verification of compliance with Section R406 as outlined in Sections N1106.3 / R406.4 2 and N1106.5 / R406.6 5 shall be completed by an *approved* third party. Verification of compliance with Section R406.2 TABLE N1106.2 / R406.2 shall be completed by the authority having jurisdiction or an *approved* third-party inspection agency in accordance with Section R105.4.

N1106.6 / R406.7 6 Documentation. Documentation of the software used to determine the ERI and the parameters for the *residential building* shall be in accordance with Sections N1106.6 / R406.7 6 .1 through N1106.6.4 / R406.7 6 .4.

N1106.6.1 R406.7 6 .1 Compliance software tools. Software tools used for determining ERI shall be *Approved* Software Rating Tools in accordance with ANSI/RESNET/ICC 301.

N1106.6.2 / R406.7 6 .2 Compliance report. Compliance software tools shall generate a report that documents that the home and the ERI score of the *rated design* complies with Sections R406.2, R406.3 and R406.4. Compliance documentation shall be created for the proposed design and shall be 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 N1106.6.2.1 / R406.7 6 .2.1 and N1106.6.2.2 / R406.7 6 .2.2.

N1106.6.2.1 / R406.7 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. Declare ERI on title page and building plans.
3. The name of the individual performing the analysis and generating the compliance report.
4. The name and version of the compliance software tool.
5. Documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
6. A certificate indicating that the proposed design has an ERI less than or equal to the appropriate score indicated in Table R406.5 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; and the type and rated efficiencies of proposed heating, cooling, mechanical ventilation, and service water-heating equipment to be installed. If on-site renewable energy systems will be installed, the certificate shall report the type and production size of the proposed system.
7. 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.

N1106.6.2.2 / R406.7 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. Declaration of ERI on title page and on building plans.
3. The name of the individual performing the analysis and generating the report.
4. The name and version of the compliance software tool.
5. Documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
6. A final confirmed certificate indicating that the confirmed rated design of the built home complies with Sections R406.2 and R406.4. 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; and the type and rated efficiencies of the heating, cooling, mechanical ventilation, and service water-heating equipment installed. Where on-site renewable energy systems have been installed on or in the home, the certificate shall report the type and production size of the installed system.

N1106.6.3 / R406.7.6 .3 Renewable energy certificate (REC) documentation. Where on-site renewable energy is included in the calculation of an ERI, one of the following forms of documentation shall be provided to the code official:

1. Substantiation that the RECs associated with the on-site renewable energy are owned by, or retired on behalf of, the homeowner.
2. A contract that conveys to the homeowner the RECs associated with the on-site renewable energy, or conveys to the homeowner an equivalent quantity of RECs associated with other renewable energy.

N1106.6.4 / R406.7.6 .4 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 calculations for the *rated design*.

N1106.6.5 / R406.7.6 .5 Specific approval. Performance analysis tools meeting the applicable subsections of Section R406 shall be *approved*. Documentation demonstrating the approval of performance analysis tools in accordance with Section R406.7.1 shall be provided.

N1106.6.6 / R406.7.6 .6 Input values. Where calculations require input values not specified by Sections R402, R403, R404 and R405, those input values shall be taken from ANSI/RESNET/ICC 301.

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.

Reason for R401.2

The purpose of this code proposal is to remove language that is not or will not be used in the City of Denver.

1. Reference to the tropical climate zone compliance alternative has been removed.
2. A proposal has been made to link the Energy Rating Index alternative compliance option, Section R406, to the Cities Climate Action Goal. The city climate action plan set ERI scores of 50 without onsite renewables. An ERI of 55 is allowed for all-electric properties. With these ERI score in place there is no need for additional energy efficiency options. By removing the R408 requirement the city might begin to see more submittals using the ERI compliance approach which will be needed in order to track compliance with the climate action goal of zero energy.

The Energy Rating Index is the metric the City has chosen to set and track the efficiency trajectory to of the 2030 goal. This proposal is the beginning of a process to formally put in place in the 2021 IECC this compliance and tracking metric.

Reason for R406

The purpose of this proposal is to establish the ERI performance compliance path for the City of Denver and the metric used to determine the trajectory achievement toward the 2030 goal. The ERI compliance

alternative is likely to become the base compliance alternative in future adoptions of the IECC because it does the following:

- EUI is not used in residential construction. The ERI score is the metric that determine zero energy for residential.
- Setting an ERI without onsite renewable production allows the ERI score to ensure sound building thermal envelopes and the use of efficient mechanicals before onsite renewables takes the home the rest of the way to Zero energy. A home cannot score below about 35-40 on the ERI scale after the envelope and mechanicals have been maximized in the design. The remainder of the path to zero energy is made up with the installation of renewables on the project.
- This amended ERI approach offers flexibility to determine the specification a design uses to reach zero energy. Tradeoffs using the UA alternative or Section R405 will become difficult or impossible to do the closer the city gets to true zero energy homes.
- The ERI compliance alternative does require the use of an Energy Rater possibly other building consultants. This, however, becomes more important as the city moves closer to Zero Energy homes because there are more building science questions that have to be addressed in the design. For example, house tightness, ventilation, condensation, permeability, fan watt draw, balance between envelope, mechanical, and renewables, etc.

The proposal creates a maximum performance ERI score for all-electric properties and mixed fuel properties. It also expands on requirement table R406.2 to ensure parity between the prescriptive path and the performance compliance path. It does this by requiring all things that are associated with installation that are required by the prescriptive path.

This proposal is based on research that has identified inconsistency with the IECC energy Rating Index to justify use of a non-modified ANSI/RESNET/ICC Standard 301 ERI score. It also recognizes that setting ERI compliance scores without OPP is a means to ensure a sound thermal envelope that is equal to the or better than the IECC prescriptive path yet offers designers and builders greater flexibility to specify energy features and building techniques to determine the most cost-effective way to achieve compliance.

The ERI score is used by the Denver NZE implementation plan to set a level of performance for the 2021 IECC adoption that will be used to calibrate the other compliance paths to. In this case an ERI score of 50 for mixed fuel properties before onsite renewable power production is added to the home.

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

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.

Referenced Standards:

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

Impact:

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

Cost of construction: ___ Increase ___ Decrease _x_ No Impact

Cost of design: ___ Increase ___ Decrease _x_ No Impact

Restrictiveness: ___ Increase ___ Decrease _x_ No Impact

This proposal in and of itself does not impact cost or restrictiveness. The cities goal of zero energy homes does and this compliance alternative helps to determine the most cost effective way to achieve this goal.

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.

Denver Green Code ERI/Passive House compliance path See DGC Proposal 23