



2022 Denver Energy Code Residential Performance Compliance Paths: Total Building Performance & Energy Rating Index

Community Planning and Development /
Office of Climate Action, Sustainability and Resiliency
Presented by Robby Schwarz BUILDTankinc
June 8, 2023

INTERPRETATION INSTRUCTIONS

- This session is available in both English & Spanish. Click on the “Interpretation” icon at the bottom of the Zoom window and choose either "English" or “Spanish”
-
- Esta sesión está disponible en inglés y español. Haga clic en el icono "Interpretación" en la parte inferior de la ventana de Zoom y elija "Inglés" o "Español"

Questions?

- Time is reserved at the end of the presentation for Q&A
- Please use the Q&A feature to submit your questions



- Responses to all questions not addressed today will be sent out by email to registered participants
- Additional questions may be sent to: energy.review@denvergov.org

Training Series



SCAN ME



**Commercial/Multifamily
(Wednesdays at 12 p.m.)**

**Residential
(Thursdays at 1 p.m.)**

Electrification May 24

Compliance Overview May 25

Prescriptive Path

May 31

June 1

Performance Paths

June 7

June 8

Contractor/Inspector Part 1

June 14

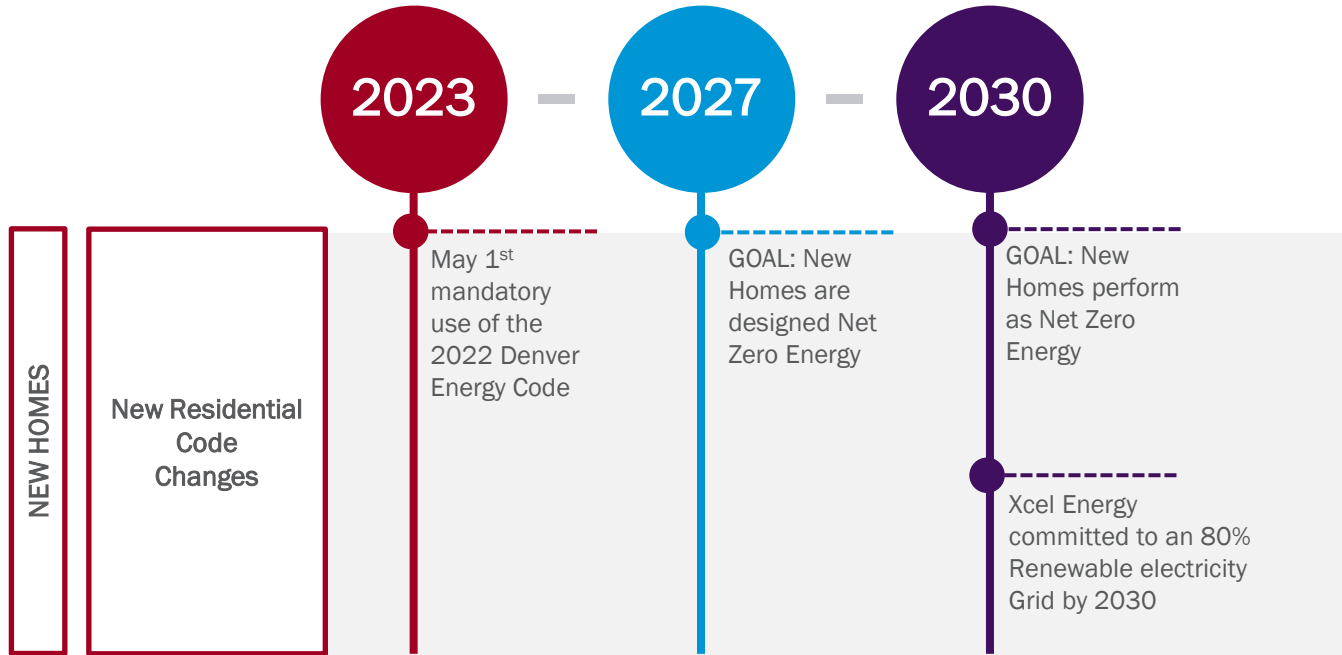
June 22

Contractor/Inspector Part 2

June 21

June 29

Timeline: Residential Electrification & Performance Goals



2022 Denver Energy Code

- This training provides as **overview** of the requirements for the **Total Building Performance and Energy Rating Index (ERI) compliance paths** of the 2022 Denver Energy Code for Residential projects
- Does not include all changes to the 2022 Denver Energy Code. Please refer to the 2022 Denver Energy Code for specific code language [Denvergov.org/BuildingCode](https://denvergov.org/BuildingCode)
- Denver-specific COMcheck and REScheck are anticipated for Fall 2023

Net Zero Energy Hub – Codes and Resources

www.denvergov.org/EnergyCode

Resources for:

- New provisions in the 2022 Denver Energy Code
- The Denver Energy Code compliance pathways
- Specifics to each phase of a new building project, from design and construction to alterations and additions
- Training videos to walk you through specific provisions that have been updated since the 2019 Denver Building Code
- Rebates for electrification equipment for existing homes

Home / Government / Agencies, Departments, and Offices / Climate Action, Sustainability & Resiliency / High Performance Buildings and Homes / **Net Zero Energy Hub - Codes and Resources**

Net Zero Energy Hub - Codes and Resources

This resource hub pulls together information from Denver and pairs it with resources from across the country to help building owners, professionals, and residents:

- Learn about changes in the 2022 Denver Building and Fire Code and the 2022 Denver Green Code
- Understand the importance of building electrification and energy efficiency
- See examples of successful Net Zero Energy building projects in a variety of building types and uses
- Navigate new regulations and requirements with confidence!



Resources for New Commercial and Multifamily Buildings

Buildings that are regulated by the Denver Commercial Building Code, which include commercial buildings and multi-unit residential buildings that are not regulated by the Denver Residential Code.



Resources for New Single Family, Duplex, and Townhomes

Any detached one- or two-family dwelling unit and townhomes three stories or less are regulated by the Denver Residential Code.

Tips for referencing code

2022 Denver Amendments

+

2021 International Energy Conservation Code (IECC)

=

2022 Denver Energy Code (DEC)

Note: Chapter 11 in the Denver Residential Code is replaced in its entirety by the Residential Provisions of the 2022 Denver Energy Code

Agenda

- 2022 DEC Compliance Overview
- Energy Modeling & Tradeoffs
- Total Building Performance
- Energy Rating Index (ERI)
- Considerations for Existing Buildings

Purpose: This presentation provides an overview of the design and permit submittal requirements for residential building projects following the performance paths.

Details on installation, testing, and as-built compliance will be covered in upcoming contractor and inspector trainings

Definition: Residential Building

Residential Buildings are detached one- and two-family dwellings and multiple single-family dwellings (townhouses) and Group R-3 and R-4 buildings **three stories or less in height** above grade plane.



(DEC Section C202)

Definition: All-Electric Property



Photo credit: [Kalen Jesse Photography](#)

An *All-Electric Property* is one that contains no permanently installed equipment or appliances that utilize *combustion*, plumbing for fuel gas or fuel oil or *fuel gas* utility connection, installed within the *building(s)* or site, except for *emergency power systems* and *standby power systems*.

2022 DEC Compliance Pathways

Residential projects may select from three compliance options:

Prescriptive	Total Building Performance	Energy Rating Index (ERI)
<p>Each element of the building must meet a minimum standard defined in prescriptive provisions</p> <p>Additional efficiency options are selected from a standard menu</p>	<p>Energy modeling analysis is used to show an annual energy cost savings for the proposed design over a baseline</p>	<p>Energy rating software is used to show the ERI of the proposed design is less than or equal to the code defined maximum</p>

See previous training for more information on Prescriptive Path requirements.

Submittal Requirements

Projects submitting for permit must provide:

- Completed **Energy Code checklist** for the selected compliance path
- **Supplemental Reports or Calculations** as required (e.g., REScheck report, ACCA Manual J, S and D Packages)
- **Construction Documents** showing all required elements, stamped & signed by licensed design professional (if applicable)

2022 Denver Energy Code - Residential Compliance Checklist
Total Building Performance Compliance Option

Project Address:

READ FIRST: Checklist Instructions & Applicability

Complete the Residential Compliance Checklist by entering relevant information in all tan-colored text boxes. Submit the completed checklist (as a PDF) with the construction documents for permit application.

This checklist identifies the minimum submittal requirements necessary to demonstrate compliance with the energy efficiency requirements of the Denver Building Code (DBC), herein referred to as the Denver Energy Code (DEC). The Denver Energy Code is comprised of the 2022 Denver amendments to the 2021 IECC. Residential provisions of the DEC start on page 300 of the 2022 *Denver Building and Fire Code*, which can be downloaded at [DenverGov.org/BuildingCode](https://denvergov.org/BuildingCode).

This checklist is not comprehensive and additional information may be required based on the individual design proposed.

The requirements of the Denver Energy Code shall be coordinated with building assembly sizes and configurations that are in conformance with all other related building code requirements, including but not limited to requirements located in the Denver Residential Code (DRC) for the vapor retarder, weather-resistance of the exterior building envelope, vented or unvented roof assemblies, the fire-resistance rated construction of the exterior walls and projections, and the structural requirements. The Denver Residential Code, which is comprised of the 2022 Denver amendments to the 2021 IRC, starts on page 183 of the 2022 *Denver Building and Fire Code*.

The following project types are required to submit a Residential Compliance Checklist:

- New one- and two-family dwellings
- New additions to one- and two-family dwellings with over 20% area increase in existing above grade gross floor area, or 300 S.F., whichever is less
- Alterations to one- and two-family dwellings with a project work area of 20% of above grade gross floor area, or 300 S.F., whichever is less
- New IRC or IBC townhouses 3 stories or less above grade plane
- New R-3 and R-4 Occupancy buildings 3 stories or less above grade plane

NOTE: This checklist does not apply to Manufactured Homes reviewed and approved by the State of Colorado Division of Housing.

Project Scope	
Please state if the project scope includes any of the following: <i>Exceptions: Repairs, alterations with less than 20% increase in conditioned floor area, additions with less than 20% increase in conditioned floor area, and change of occupancy to the same or lower energy-demand category are not required to submit this checklist.</i>	<input type="checkbox"/> All-Electric Property <input type="checkbox"/> New Construction <input type="checkbox"/> Addition <input type="checkbox"/> Increase in conditioned space <input type="checkbox"/> Change of Occupancy to Higher Energy-Demand Category

Scope of Project	
Alteration and Additions Only: For existing homes, provide calculation of the increase in conditioned floor area as a percentage of the total existing above grade conditioned floor area.	<input type="text"/>

Compliance checklists for each pathway and an instructional video on how to complete the checklists can be found [here](#).

Permit Fee Discount for 3rd Party Inspections

- Projects that are inspected by a third-party inspection agency (Energy Rater) are **eligible for a discount of \$150 on permit fees**
 - DEC Section R105.4.2.1 Approved third-party inspector shall be an accredited RESNET HERS Rater, BPI Building Analyst, IECC/HERS Compliance Specialist, or have IECC residential energy inspector/plans examiner certification
 - With your permit application, submit the **Homeowner Energy Rater Verification Form**

HOMEOWNER ENERGY RATER VERIFICATION FORM
CITY & COUNTY OF DENVER
COMMUNITY PLANNING & DEVELOPMENT

Projects that are inspected by a (third-party inspection agency) Energy Rater are eligible for a discount of \$150 on permit fees. To obtain the fee reduction, include this with submittal for permit application.

I (responsible party), _____, (representing) _____
the (circle one) **builder/contractor, owner, or owner's agent**, hereby agree to use the following approved Energy Rater.

Subject Property Address _____

Energy Rater (print name) _____ Certificate Number (RITN #) _____

Energy Rater (signature) _____ Date _____

Email _____ Phone _____

The Responsible Party as noted above acknowledges that the subject property meets or exceeds the current Denver Energy Code.

I also understand that a home completed without the use of an Energy Rater (after signing this agreement) will result in the forfeiture of the \$150.00 permit fee reduction and that compliance with the current Denver Energy Code must still be demonstrated for Certificate of Occupancy by the City and County of Denver.

Download the Residential Energy Code submittal policy at [Denvergov.org/BuildingCode](https://denvergov.org/BuildingCode)

Instructions for CPD Plans Reviewers

- To facilitate inspections, record in Permit Scope of Work text box on permit:
 - One **compliance pathway** from four options
 - » Prescriptive Compliance Path
 - » Prescriptive: Total UA Alternative
 - » Total Building Performance
 - » Energy Rating Index (ERI)
 - Selected **additional energy efficiency packages** (for Prescriptive and Total UA)
 - Proposed **renewable energy system** (DEC R404.7, if applicable)
 - Record if **All-Electric Property**

Note: dedicated Accela fields for this information are in development



Introduction to Energy Modeling & Tradeoffs

Energy Modeling Software

- Uses a Software Generated **Energy Model**



Image Source: Ekotrope

REM/RateTM
ekotrope

REScheck software does not have the ability to model for Total Building Performance or Energy Rating Index



Energy Modeling

- Both the Total Building Performance and Energy Rating Index compliance options utilize **whole-building energy modeling** to simulate building energy use and compare the proposed design to a reference design
- Encourages a holistic design process that allows for more compliance flexibility through **energy tradeoffs**

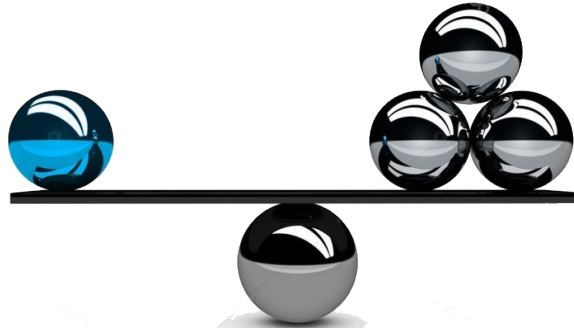
Successful energy modeling typically requires proprietary software and knowledge of building science.

Projects following a performance-based pathway will likely need to hire an **energy modeler or building design professional** to complete the modeling and ensure the proposed design meets all requirements of the code.

Tradeoffs

- A trade off refers to putting something **more in one assembly** so you can put something **less in another**
 - The energy performance scale remains balanced
- You can tradeoff *U*-factors, *R*-values, **air tightness, duct leakage**, and system and appliance performance, depending on compliance approach

The **blue ball** represents ceiling insulation of R-38 (less than prescriptive R-60)



The **3 silver balls** represent window, air leakage, and duct location that exceed minimum requirements, thus balancing the energy equation

How The Software Works

(The Simple Version)

- **Delta T (ΔT):** The difference in temperature across a building component that governs heat loss or gain
- The software describes the thermal envelope and its location or ΔT to ambient air or dirt
 - Every building component that is entered on a data entry page is located with respect to ambient air, dirt, or a buffer space of a different temperature
 - Describing heat loss

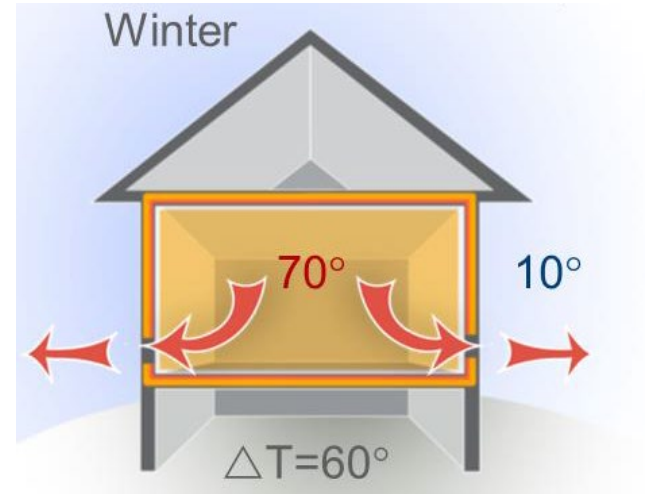


Image Source: HVACDesignPros.com

Energy/heat always flows from
warm to cold
or
more to less

Software Basics

- The software creates a **reference home** which the home you are analyzing is compared to in order to quantify performance or demonstrate compliance
- Reference Home/Design
 - A standard set of house specifications that generate specific, consistent, and quantifiable energy performance
- Types of reference homes:
 - UA Alternative Reference home
 - **DEC R405 Standard Reference home**
 - **IECC ERI Reference home (DEC R406)**
 - HERS ERI Reference home
 - Energy Star Reference home
 - User defined reference home



Image Source: Patch.com

Building Science Built into the Code

PERFORMANCE PATH OPTIONS PROVIDE FLEXIBILITY

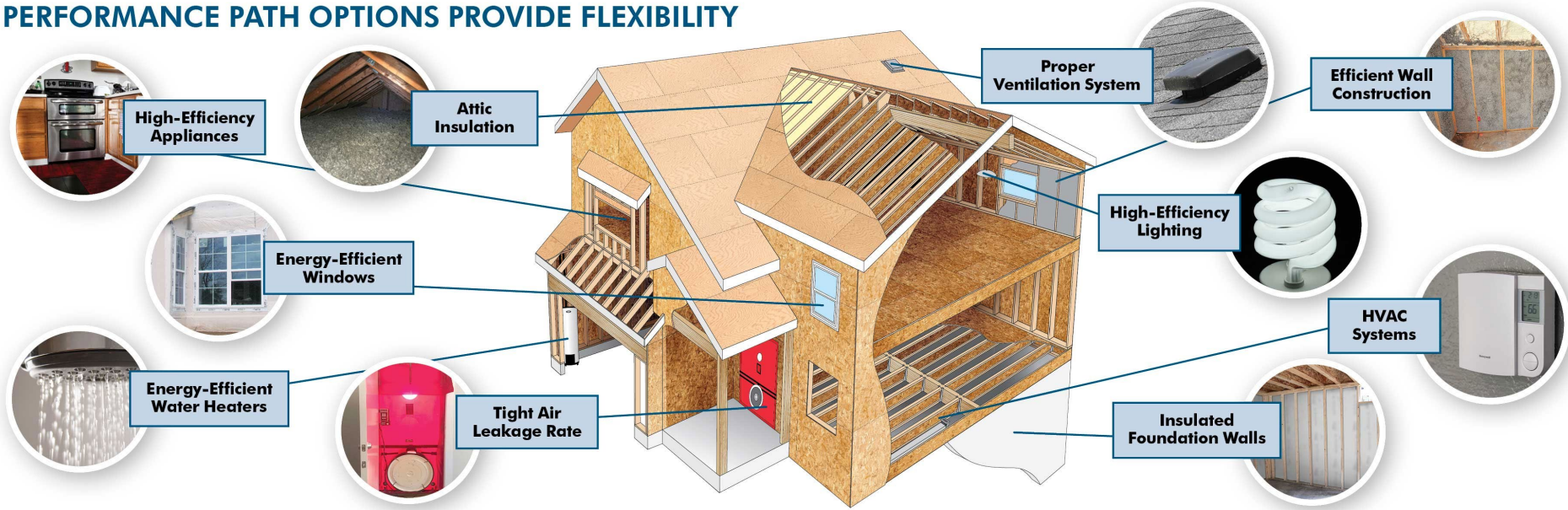


Image Source: APAwood.org



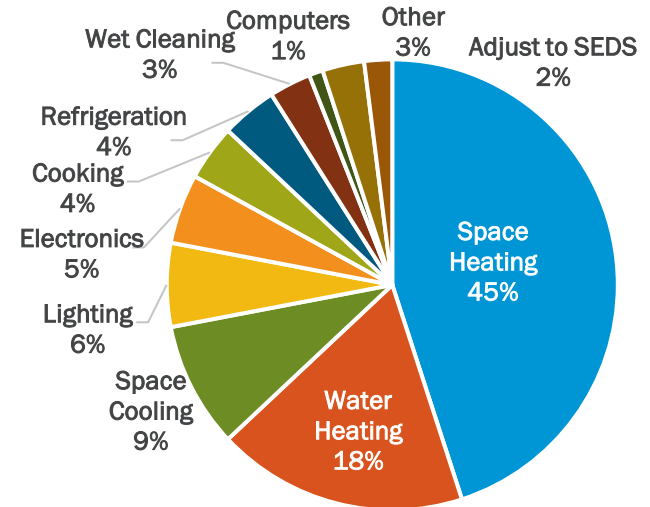
Total Building Performance Compliance Option

DEC Section R405

Total Building Performance

Scope of Analysis

- **DEC R405.1 Scope.** This section establishes criteria for compliance using Total Building Performance analysis
- Such analysis shall include
 - Heating
 - Cooling
 - Mechanical ventilation
 - Service water heating energy only
- **No mechanical or solar trade offs**



Residential Site Energy
Consumption by End Use

Source: CaliforniaGeo.org

Total Building Performance

Twin House Concept

Proposed Design

- Geometric Twin
- Envelope *U*-factors based on design specifications (minimum efficiency set by back stop)



VS.

Standard Reference Design

- Geometric Twin
- Envelope as defined by the reference home specifications in DEC Table R405.4.2(1)



Total Building Performance

Energy Cost Compliance

- DEC Section R405.2 Performance-based compliance
- 3. An **annual energy cost** that is less than or equal to **95% of the annual energy cost for all-electric properties (82% for all other buildings)** of the *standard reference design*.
 - Energy prices shall be taken from a source approved by the *building official*, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. The building official shall be permitted to require time-of use pricing in energy cost calculations when such data is available from the local utility.
- **Exception:** Energy use based on source energy may be substituted for energy cost using the multipliers provided in the code



Image Source: CallReeves.com

Total Building Performance

Standard Reference Design

- DEC Table R405.4.2(1) outlines the **Specifications for the Standard Reference and Proposed Designs** used for Total Building Performance Compliance
- Remember the Reference Design is ...
 - A standard set of house specifications that generate specific, consistent, and quantifiable energy performance

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Above-grade walls	Type: mass where the proposed wall is a mass wall; otherwise wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U -factor: as specified in Table R402.1.2.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed

Total Building Performance

What does it mean for my project?

DEC Section R405.2

- Requirements for the *proposed design*:
 1. Meet all requirements of sections in Table R405.2
 2. Building thermal envelope greater than or equal to efficiency levels of 2009 IECC (backstop)
 3. Annual **energy cost savings** (compared to the *reference design*):

All-Electric Properties	All Other Buildings
5%	18%



Image Source: TES.com

Total Building Performance

DEC Table R405.2

Tables R405.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE	
SECTION	TITLE
General	
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.3	Eave baffle
R402.2.4.1	Access hatches and doors
R402.2.8.1	Basement Wall Insulation Installation
R402.2.9.1	Slab-on-grade floor insulation installation
R402.2.10.1	Crawl space wall insulation installation
R402.4.1.1	Installation
R402.4.1.2	Testing
R402.4.2	Fireplaces
R402.4.3	Fenestration air leakage
R402.4.4	Rooms containing fuel burning appliances
R402.4.5	Recessed lighting
R402.4.6	Electrical and communication outlet boxes (air Sealed boxes

*See first training in series for more information
on provisions required for all pathways*

Tables R405.2 (Continued) REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE	
SECTION	TITLE
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Ducts
R403.4	Mechanical system piping insulation
R403.5.1	Heated water circulation and temperature maintenance systems
R403.5.3	Drain water heat recovery units
R403.5.4	Water heating equipment location
R403.5.5	Demand Responsive Water Heating
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
R404.2	Interior lighting controls
R404.4	Electric Vehicle Charging Requirements
R404.5	Additional Electrical Infrastructure
R404.6	Solar Ready Zone
R404.7	Minimum renewable energy system capacity

Total Building Performance

Building Thermal Envelope

DEC Section R405.2 establishes a backstop to ensure a minimum level of performance

2. The building thermal envelope **shall be greater than or equal to** levels of efficiency and Solar Heat Gain Coefficient in Table 402.1.1 or 402.1.3 of the **2009 *International Energy Conservation Code (IECC)***



Image Source: laxdrip.com

Total Building Performance

Additional Efficiency Packages **NOT** Required

DEC Section R408 is only required for Prescriptive Compliance

Requirements for All Electric Properties	Requirements for All Other Buildings
Compliance with High OR Premium Performance Electric Space Heating package (R408.8.2 OR R408.3)	
Compliance with High Performance Electric Water Heating in Conditioned OR Unconditioned Space package (R408.10.2 OR R408.10.3)	18 Credits from Table R408.1
3 Credits form Table R408.1	

Total Building Performance

Compliance Documentation

DEC R405.3 Documentation:

- An initial “projected” compliance report on the **proposed design** shall be submitted with the application for the **building permit**
 - Software generated report demonstrating that the proposed design meets the requirements of R405.2

Report must include:

1. **Address** or other identification of the building
2. **Declaration of Total Building Performance Compliance option** on title page of building plans
3. **Name of individual** completing the compliance report
4. Name and version of the **compliance software tool**
5. **Documentation of all inputs** in the software used for the reference design and/or the rated home
6. A **certificate** indicating proposed/confirmed design has an annual energy cost that is less than or equal to required target based on building type

Total Building Performance

Report Example:

REM/Rate™

2021 IECC Energy Cost Compliance

Property Best House Ever , CO 80237	Organization BuildTank, Inc. 303-927-0025 Robby Schwarz	HERS Confirmed 4/2/2021 Rating No: LZVQq8L Rater ID: 9124083	BUILD Tank _{inc.}	
Weather: Denver Intl AP, CO 2021 IECC test house DRH House for Denver. blg	Builder DRH			
Annual Energy Cost			\$/yr	
	2021 IECC		As Designed	
Heating	340		289	
Cooling	134		139	
Water Heating	108		108	
Mechanical Ventilation Fan	19		23	
SubTotal - Used to Determine Compliance	601		559	
Lights & Appliances (minus MechVent)	627		576	
Photovoltaics	-0		-0	
Service Charge	240		240	
Total	1468		1375	

Note: REM/Rate does not include DEC amendments, submitter must confirm the energy savings meet the required threshold based on building type

NO PRINT

Mandatory Requirements	
Annual Energy Cost Check	PASSES
Duct Insulation R-Value Check (per Section 405.2)	PASSES
Window U-Value and SHGC Check (per Section 402.5)	PASSES
Skylight U-Value Check (per Section 402.5)	PASSES
Home Infiltration (Section 402.4.1)	PASSES
Duct Testing (Section 403.3.5)	PASSES
Mechanical Ventilation (Section 403.6)	PASSES
Mechanical Ventilation Fan Efficacy (Section 403.6.1)	PASSES
Mandatory Requirements Check Box (2021 IECC)	PASSES
High efficacy lights installed(100 %)	PASSES

This home **MEETS** the annual energy cost requirements of Section 405 of the 2021 International Energy Conservation Code based on a climate zone of 5B. In fact, this home surpasses the requirements by 7.0%.

Name Robby Schwarz	Signature
Organization BuildTank, Inc.	Date 10 May 2023

“This home **MEETS** the annual energy cost requirements of Section 405 of the **2021 IECC** based on a climate zone of 5B. In fact, this home **surpasses the requirements by 7.0%**”

In accordance with IECC, building inputs, such as setpoints, infiltration rates, and window shading may have been changed prior to calculating annual energy cost. Furthermore, the standard reference design HVAC system efficiencies are set equal to those in the design home as specified in the 2021 IECC. These standards are subject to change, and software updates should be obtained periodically to ensure the compliance calculations reflect current federal minimum standards.

REMRate - Residential Energy Analysis and Rating Software v16.3.4
This information does not constitute any warranty of energy costs or savings.
© 1985-2022 NORESKO, Boulder, Colorado.

Total Building Performance

Report Example: ekotrope

Note: ekotrope does not include DEC amendments, submitter must confirm the energy savings meet the required threshold based on building type

IECC 2021 Performance Compliance

Property
CO
Model: D437 Salida
Ft Collins DR Horton - D437 Salida
2021 IECC test house

Organization
BuildTank, Inc.
Robby Schwarz
303-927-0025

Inspection Status
Results are projected



This report is based on a proposed design and does not confirm field enforcement of design elements.

Annual Energy Cost		
Design	IECC 2021 Performance	As Designed
Heating	\$564	\$535
Cooling	\$78	\$82
Water Heating	\$145	\$145
Mechanical Ventilation	\$41	\$25
Sub Total - Used to determine compliance	\$829	\$787
Lights & Appliances w/out Ventilation	\$707	\$707
Onsite generation	\$0	\$0
Total	\$1,535	\$1,493

R405.3 Source Energy Exception: The proposed home uses 4.89 MBtu LESS source energy than the reference home.

“Design exceeds the requirements for 2021 IECC Performance compliance by 5%”

Requirements		
✓ R405.2	Performance-based compliance passes by 5.0%	The proposed house meets the IECC 2021 Performance reference energy bill requirement by \$41.6 (4.89 MBtu).
✓ R405.2 Item 2	Total UA alternative compliance passes by 23.1%. The proposed home meets the UA requirement by 23.1%	
✓ R405.2 Item 2	Glazed Fenestration SHGC	
✓ R402.4.1.2	Air Leakage Testing	Air sealing is 3.00 ACH at 50 Pa and 0.21 CFM50 / ft ² Shell Area. It must not exceed 5.00 ACH at 50 Pa or 0.28 CFM50 / ft ² Shell Area.
✓ R403.3.1	Duct Insulation	All ducts outside the thermal envelope must be insulated to at least R6.0
✓ R404.1	Lighting Equipment	At least 100.0% of fixtures shall be high-efficacy lamps, currently 100.0% are high-efficacy
✓ Mandatory Checklist	Mandatory code requirements that are not checked by Ekotrope must be met.	2021 IECC Required items must be checked as complete
✓ R403.0.2	Mechanical Ventilation Efficacy	
✓ R403.6.1	Mechanical Ventilation Energy Recovery	
✓ R402.5	Area-weighted average fenestration SHGC	Area-weighted average fenestration SHGC is 0.4. The maximum allowed value is [No Limit].
✓ R402.5	Area-weighted average fenestration U-Factor	
✓ R401.2.5 Option 2	Additional energy efficiency	R401.2.5.2.2 - 95% Threshold Met.

Design exceeds requirements for IECC 2021 Performance compliance by 5%.

As a 3rd party extension of the code jurisdiction utilizing these reports, I certify that this energy code compliance document has been created in accordance with the requirements of Chapter 4 of the adopted International Energy Conservation Code based on LARIMER County. If rating is Projected, I certify that the building design described herein is consistent with the building plans, specifications, and other calculations submitted with the permit application. If rating is Confirmed, I certify that the address referenced above has been inspected/tested and that the mandatory provisions of the IECC have been installed to meet or exceed the intent of the IECC or will be verified as such by another party.

Name: Robby Schwarz
Organization: BuildTank, Inc.
Signature: 
Digitally signed: 5/8/23 at 8:00 PM

Total Building Performance

Compliance Report must document all inputs

IECC 2021 Reference Home Summary

Property
 .CO
 Model: D437 Salida

Organization
 BuildTank, Inc.
 Robby Schwarz
 303-927-0025

Inspection Status
 Results are projected

Builder
 Dr Horton

Ft Collins DR Horton - D437 Salida
 IECC 2021 Reference



IECC 2021 Proposed Home Summary

Property
 .CO
 Model: D437 Salida

Organization
 BuildTank, Inc.
 Robby Schwarz
 303-927-0025

Inspection Status
 Results are projected

Builder
 Dr Horton

Ft Collins DR Horton - D437 Salida
 IECC 2021 Proposed



General Building Information

Number Of Bedrooms	3
Number Of Floors	1
Conditioned Floor Area [sq. ft.]	3,158
Has Electric Vehicle Ready Space	No
Unconditioned, attached garage?	Yes
Conditioned Volume [cu. ft.]	29,733
Total Units in Building	1
Residence Type	Single family detached
Number of Floors in Building	-
Floor Number	-
Model	D437 Salida
Community	
RESNET/IECC 2006-2018 Climate Zone	5B
IECC 2021 Climate Zone	5B

General Building Information

Number Of Bedrooms	3
Number Of Floors	1
Conditioned Floor Area [sq. ft.]	3,158
Has Electric Vehicle Ready Space	No
Unconditioned, attached garage?	Yes
Conditioned Volume [cu. ft.]	29,733
Total Units in Building	1
Residence Type	Single family detached
Number of Floors in Building	-
Floor Number	-
Model	D437 Salida
Community	
RESNET/IECC 2006-2018 Climate Zone	5B
IECC 2021 Climate Zone	5B

Foundation Wall

Name	Library Type	Height Above Grade	Depth Below Grade	Perimeter	Location	Enclosing
Base	IECC 2021 Reference	1	9	160	Exposed Exterior	Conditioned Space
Garage	IECC 2021 Reference	1	8	38	Exposed Exterior	Conditioned Space

Foundation Wall

Name	Library Type	Height Above Grade	Depth Below Grade	Perimeter	Location	Enclosing
Base	R-15 Perforated FG Blanket	1	9	160	Exposed Exterior	Conditioned Space
Garage	R-15 Perforated FG Blanket	1	8	38	Exposed Exterior	Conditioned Space

Total Building Performance

Certificate Examples

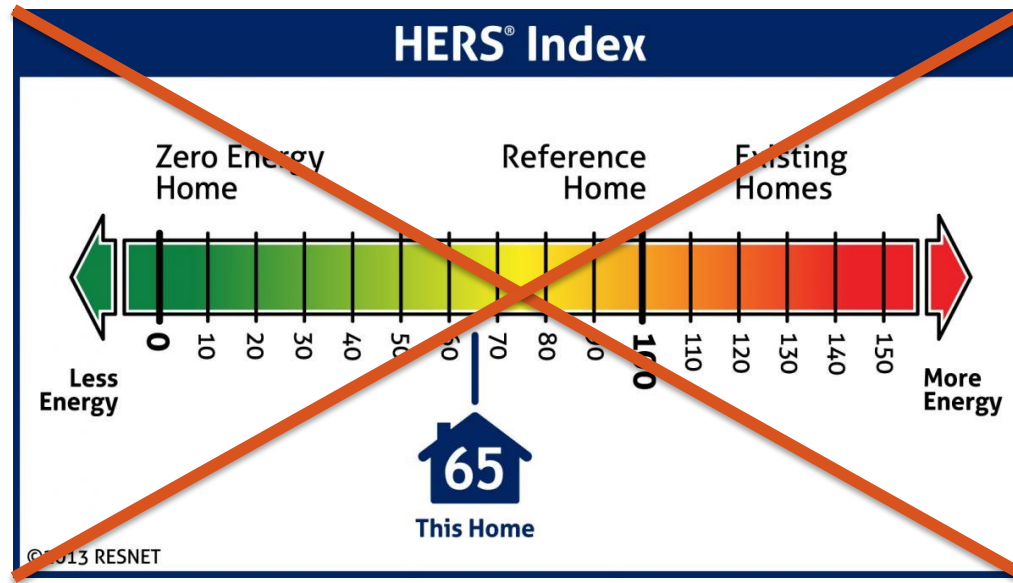
DEC Section R401.3 requires a permanent certificate be posted in the finished home that lists key specifications of the design

IECC 2021 Label	
Model: D437 Salida Ekotrope RATER - Version: 4.0.0.3154	
Building Envelope Specs	
Ceiling: R-60 Above Grade Walls: R-25 Foundation Walls: R-15 Exposed Floor: N/A Slab: R-10 Infiltration: 3 ACH50 Duct Insulation: Supply: R0, Return: R0 Duct Lkg to Outdoors: 10 CFM @ 25Pa (0.32 / 100 ft ²)	
Window & Door Specs	
U-Value: 0.3, SHGC: 0.4 Door: R-6	
Mechanical Equipment Specs	
Heating: Furnace • Natural Gas • 80 AFUE Cooling: Air Conditioner • Electric • 13 SEER Hot Water: Residential Water Heater • Natural Gas • 0.59 UEF Average Mechanical Ventilation: 74.5 CFM	
Builder or Design Professional	
Signature: _____	

BUILD Tank^{inc.} <small>A Pragmatic Building Think Tank</small>			
			<small>Analyst, Synergist, Catalyst</small>
2021 IECC R401 Label/Certificate			Date: 12/26/2022
Builder:	Best Builder Ever	RESNET HERS ERI: N/A	
Address:	123 Best place to live	IECC ERI with PV: N/A	
Jurisdiction:	The Best County Colorado	IECC ERI w/out PV: N/A	
Compliance Path:	Prescriptive		
Building Envelope Specifications:			
▪ Ceiling	R - 60		
▪ Above Grade Walls	R - 23+5		
▪ Exposed Floors	R - 50		
▪ Foundation Walls	R - 19		
▪ Slab/Slab edge	R - 10		
▪ Duct in unconditioned space	R - 8		
▪ Exterior Door R-Value	R - 6		
▪ Window/Skylight U-Value / SHGC	U-value: 0.27	SHGC: 0.27	
Mechanical Equipment Specification			
	Type	Efficiency	
Heating	Gas Furnace	AFUE 96	
Cooling	Air Conditioner	SEER 16	
Water Heating	Gas 50 Gallon	UEF 96	
Building Performance Data			
Envelope Infiltration: Air Changes Per Hour @50 Pascals	1.5 ACH50		
Ventilation Type: Balanced	75 CFM flow		
Duct Leakage compliance target:	N/A Sqft conditioned space served: 4000		
4CFM/100sqft of conditioned floor area	N/A CFM target 160		
Measured Total Duct Leakage:	50 CFM25		
Measured Duct Leakage to Outside:	25 CFM25		
Photovoltaic systems			
Array Capacity	Inverter Efficiency	Panel Tilt	Panel Orientation
N/A	N/A	N/A	N/A
Robby Schwarz IECC Residential Energy Inspector/Plans Examiner/HERS/ERI Performance Specialist			

NOTE: An ERI can be a Byproduct of R405 Compliance

In this case the ERI is not a code compliance document.



Total Building Performance

Final Compliance Documentation

DEC R405.3 Documentation:

- Upon completion of the building, a **confirmed compliance report based on the confirmed condition of the building** shall be submitted to the code official before a certificate of occupancy is issued
 - R405.3.2.2 Compliance report for **certificate of occupancy**

Note: Considerations for contractors and inspectors will be covered in more detail in the next two trainings in this series





Energy Rating Index (ERI) Compliance Option

DEC Section R406

What is Home Energy Rating?

- A **home energy rating** is a calculated measure of a home's energy efficiency compared to a baseline reference home
- Most well-known: **HERS Energy Rating Index**
 - Proprietary index established in 2006 by RESNET
 - Variety of uses, including verification for energy efficiency mortgages, EPA's ENERGY STAR Homes Program, DOE's Zero Energy Ready Homes Program, and federal tax incentives

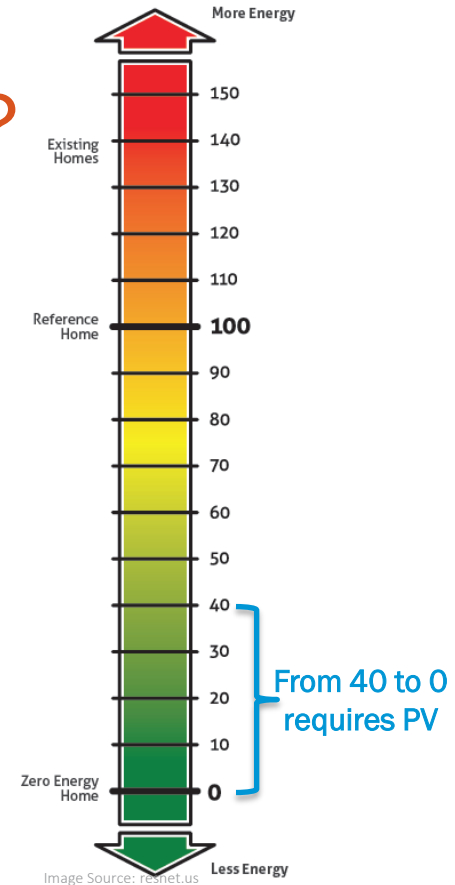


Image Source: Impresa Modular

*HERS = Home Energy Rating System
RESNET = Residential Energy Services Network*

What is the Energy Rating Index (ERI)?

- Total building energy performance model, including mechanical systems
- An index scale:
 - Like a golf score lower is better
 - Miles/gallon rating system for Homes
- The ERI Reference Home is **100** on the scale
 - Equal to the 2006 IECC
 - ERI Index of **0** = Net-Zero Energy home
- ERI Index of **130** = Average existing home (DOE)



ERI in the Energy Code

- Energy Rating Index (ERI) added as compliance option in 2015 International Energy Conservation Code (IECC)
- Calculation based on ANSI/RESNET/ICC 301 Standard
 - Developed by RESNET and ICC
 - Publicly available standard vs. proprietary
 - Basis for both IECC ERI and HERS ERI

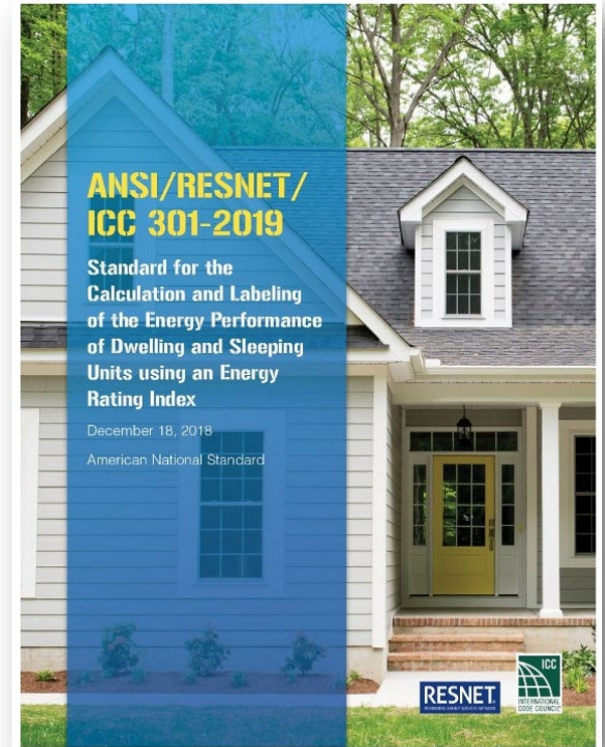


Image Source: Contractor Resource

DEC Amends ERI Scope from IECC

DEC Amended Provision

DEC Section R406.3 Energy Rating Index

- DEC ERI based only on ANSI/RESNET/ICC 301 to align with HERS ERI
 - Amends out a ventilation equation in IECC that causes divergence in scores
 - Goal: to simplify process, eliminate confusion

A RESNET HERS ERI report meets the requirements for 2022 DEC ERI

Home Energy Rating Certificate Rating Date: 2021-03-13
Projected Report Registry ID:
Based on Plans Ekotrope ID: 12377mY2

HERS® Index Score: **50** Your home's HERS score is a relative performance score. The lower the number, the more energy efficient the home. To learn more, visit www.hersindex.com

Annual Savings* **\$4,050** *Relative to an average U.S. home

Home: 9446 Cherrywood Trail, Littleton, CO 80161
Builder: Gordy Gardner

Home's Estimated Energy Use:

Use (MBtu)	Annual Cost
Heating	\$1,266
Cooling	0.0
Hot Water	11.8
Lights/Appliances	36.1
Service Charges	0.0
Generation (e.g. Solar)	0.0
Total:	205.6

Home Feature Summary:

Home Type:	Single family detached
Model:	N/A
Community:	N/A
Conditioned Floor Area:	6,516 ft ²
Number of Bedrooms:	4
Primary Heating System:	Furnace + Natural Gas + 96.5 AFUE
Primary Cooling System:	Air Conditioner + Electric + 18 SEER
Primary Water Heating:	Recirculating Water Heater + Natural Gas + 0.99 UEF
House Tightness:	2 ACH50
Ventilation:	175 CFM @ 50 Pa/ps + Exhaust Only
Duct Leakage to Outside:	25 CFM @ 25Pa @ 0.77 (100 ft ²)
Above Grade Walls:	R-6
Ceiling:	Washed Roof: R-60
Window Type:	U-Value 0.22, SHGC 0.35
Foundation Walls:	R-23
Framed Floor:	R-51

This home meets or exceeds the criteria of the following:

- 2021 International Energy Conservation Code
- 2018 International Energy Conservation Code
- 2015 International Energy Conservation Code
- 2012 International Energy Conservation Code

Rating Completed by:

Energy Rater: Bobby Schwanz
RESNET® ID: 9124003
Rating Company: BuildTank, Inc.
info@buildtank.com
303-927-0025
Rating Provider: EnerLogic
P.O. Box 9, Berthoud, CO 80513
970.556-0339

Bobby Schwanz
Bobby Schwanz, Certified Energy Rater
Digitally signed: 3/10/23 at 4:53 PM

Ekotrope
Ekotrope (METER) Version: 03.1.3154
The Energy Rating Disclosure for this home is available from the Approved Rating Provider.

Energy Rating Index (ERI)

Twin House Concept

Proposed Design

- Geometric Twin
- Envelope *U*-factors/*R*-values and mechanical systems based on design specifications



VS.

Standard Reference Design

- Geometric Twin
- ANSI Standard 301 Reference Home – equivalent to 2006 IECC



Energy Rating Index (ERI)

What does it mean for my project?

DEC Section R406.2

- Requirements for the *rated design*:
 1. Meet all the requirements of sections in Table R406.2
 2. Have an **ERI score less than or equal to** values indicated in Table R406.4

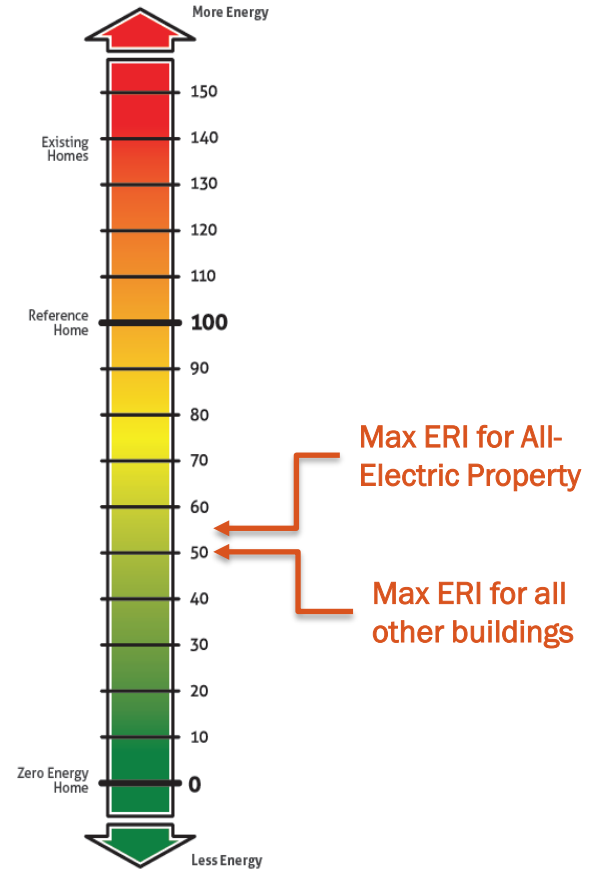
Table R406.4 Maximum Energy Rating Index (ERI)	
<i>All-Electric Properties</i>	<i>All Other Buildings</i>
55	50

Energy Rating Index (ERI)

Built in Backstop

The maximum ERI values establishes a **backstop** by ensuring a minimum level of performance

- Compliance based on an ERI analysis requires that the **rated proposed design** and **confirmed built dwelling** be shown to have an ERI score less than or equal to the appropriate value **prior to renewables** when compared to the ERI reference design.



Energy Rating Index (ERI)

DEC Table R406.2

Tables R406.2 REQUIREMENTS FOR ENERGY RATING INDEX	
SECTION	TITLE
General	
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.3	Eave baffle
R402.2.4.1	Access hatches and doors
R402.2.8.1	Basement Wall Insulation Installation
R402.2.9.1	Slab-on-grade floor insulation installation
R402.2.10.1	Crawl space wall insulation installation
R402.4.1.1	Installation
R402.4.1.2	Testing
R402.4.2	Fireplaces
R402.4.3	Fenestration air leakage
R402.4.4	Rooms containing fuel burning appliances
R402.4.5	Recessed lighting
R402.4.6	Electrical and communication outlet boxes (air Sealed boxes)

*See first training in series for more information
on provisions required for all pathways*

Tables R406.2 (Continued) REQUIREMENTS FOR ENERGY RATING INDEX	
SECTION	TITLE
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Ducts
R403.4	Mechanical system piping insulation
R403.5.1	Heated water circulation and temperature maintenance systems
R403.5.3	Drain water heat recovery units
R403.5.4	Water heating equipment location
R403.5.5	Demand Responsive Water Heating
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
R404.2	Interior lighting controls
R404.4	Electric Vehicle Charging Requirements
R404.5	Additional Electrical Infrastructure
R404.6	Solar Ready Zone
R404.7	Minimum renewable energy system capacity

Energy Rating Index (ERI)

Additional Efficiency Packages **NOT** Required

DEC Section R408 is only required for Prescriptive Compliance

Requirements for All Electric Properties	Requirements for All Other Buildings
Compliance with High OR Premium Performance Electric Space Heating package (R408.8.2 OR R408.3)	
Compliance with High Performance Electric water Heating in Conditioned OR Unconditioned Space package (R408.10.2 OR R408.10.3)	18 Credits from Table R408.1
3 Credits form Table R408.1	

Energy Rating Index (ERI)

Compliance Documentation

DEC R406.7 Documentation:

- An initial “projected” compliance report on the **proposed design** shall be submitted with the application for the **building permit**
 - Software generated report demonstrating that the rated design meets the requirements of R406.4

Report must include:

1. **Address** or other identification of the building
2. **Declaration of ERI Compliance option** on title page of building plans
3. **Name of individual** completing the compliance report
4. Name and version of the **compliance software tool**
5. **Documentation of all inputs** in the software used for the reference design and/or the rated home
6. A **certificate** indicating proposed/confirmed design has an ERI less than or equal to required target

Energy Rating Index (ERI)

Determining & Verifying the ERI

DEC R406.5 Verification by approved agency

- Verification of compliance with Section R406 as outlined in Sections R406.4 and R406.5 **shall be completed by an *approved third party***.
- Verification of compliance with Table R406.2 shall be completed by the Agency or ***an approved third-party inspection agency*** in accordance with Section R105.4.
 - Submit a **Homeowner Energy Rater Verification Form** with permit submittal for a discount on permit fees
 - Submit a completed **Energy Rater Inspection Form** before final inspection to document compliance (see *Residential Energy Code Policy*)

DEC Section R105.4

Approved Third-Party Inspection Agencies

The Agency is authorized to accept reports of third-party inspection agencies not affiliated with the *building* construction, provided that such agencies are *approved* as to qualifications and reliability relevant to the *building* components and systems that they are inspecting or testing.

- R105.4.2.1 Third-Party Credentials. *Approved* third-party inspector shall be an accredited RESNET HERS Rater, BPI Building Analyst, IECC/HERS compliance specialist, or have IECC residential energy inspector/plans examiner certification.
- R105.4.2.2 Approved third-party inspections reporting. The *approved* agency shall submit rough and final inspection reports to the code official and to the owner's representative in accordance with Section R105.2 and R105.4

Energy Rating Index (ERI)

Reporting: Proposed Design

Proposed can be worst case orientation & specifications



Home Energy Rating Certificate

Projected Report
Based on Plans

Rating Date: 2021-03-13
Registry ID:
Ekotrope ID: 12377mY2

BUILDTank

HERS® Index Score:

50

Your home's HERS score is a relative performance score. The lower the number, the more energy efficient the home. To learn more, visit www.hersindex.com

Annual Savings*

\$4,050

*Relative to an average U.S. home

Home:
9446 Cherrywood Trail
Littleton, CO 81611

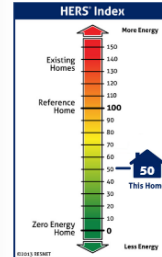
Builder:
Gordv Gardner

Your Home's Estimated Energy Use:

	Use [MBtu]	Annual Cost
Heating	157.6	\$1,566
Cooling	0.0	\$1
Hot Water	11.8	\$106
Lights/Appliances	36.1	\$1,212
Service Charges		\$0
Generation (e.g. Solar)	0.0	\$0
Total:	205.6	\$2,884

~~This home meets or exceeds the criteria of the following:~~

- ~~2021 International Energy Conservation Code~~
- ~~2018 International Energy Conservation Code~~
- ~~2015 International Energy Conservation Code~~
- ~~2012 International Energy Conservation Code~~



Home Feature Summary:

Home Type: Single family detached
Model: N/A
Community: N/A
Conditioned Floor Area: 6,516 ft²
Number of Bedrooms: 4
Primary Heating System: Furnace • Natural Gas • 96.5 AFUE
Primary Cooling System: Air Conditioner • Electric • 16 SEER
Primary Water Heating: Residential Water Heater • Natural Gas • 0.96 UEF
House Tightness: 2 ACH50
Ventilation: 175 CFM • 50 Watts • Exhaust Only
Duct Leakage to Outside: 25 CFM @ 25Pa (0.77 / 100 ft²)
Above Grade Walls: R-46
Ceiling: Vaulted Roof, R-60
Window Type: U-Value: 0.22, SHGC: 0.35
Foundation Walls: R-23
Framed Floor: R-51

Rating Completed by:

Energy Rater: Robby Schwarz
RESNET ID: 9124083
Rating Company: BuildTank, Inc.
robby@btankinc.com
303-927-0025

Rating Provider: EnergyLogic
PO Box N, Berthoud, CO 80513
(970) 556-0839

Robby Schwarz

Robby Schwarz, Certified Energy Rater
Digitally signed: 5/10/23 at 4:53 PM



Ekotrope RATER - Version:4.0.1.3154

The Energy Rating Disclosure for this home is available from the Approved Rating Provider.



Energy Rating Index (ERI)

Reporting: Confirmed Design

Confirmed must be **site specific** and certify the actual specifications and testing results found during site inspections

Home Energy Rating Certificate

Confirmed Report

Rating Date:
Registry ID: 631462669
Rating Number: 631462669

ekotrope

HERS® Index Score:
47
Your home's HERS score is a relative performance score. The lower the number, the more energy efficient the home. To learn more, visit www.HERSindex.com

Annual Savings
\$5,912
*Relative to an average U.S. home

Home:
123 Fake St. Anytown, CO
Builder:
Ekotrope

Your Home's Estimated Energy Use:

	Use (MBtu)	Annual Cost
Heating	77.0	\$2,182
Cooling	0.9	\$53
Hot Water	17.1	\$240
Lights/Appliances	36.0	\$1,944
Service Charges		\$0
Generation (e.g. Solar)	23.1	-\$2,689
Total:	131.1	\$1,730

Home Feature Summary:

Home Type: Single family detached
Conditioned Floor Area: 4,500 sq. ft.
Number of Bedrooms: 4
Primary Heating System: Furnace - Natural Gas - 95 AFUE
Primary Cooling System: Air Conditioner - Electric - 16 SEER
Primary Water Heating: Water Heater - Natural Gas - 0.67 Energy Factor
House Tightness: 1660 CFM50
Duct Leakage to Outside: 0 CFM25
Above Grade Walls: R-21
Ceiling: R-50
Window Type: U-Value: 0.310, SHGC: 0.250
Foundation Walls: R-11

HERS Index

Rating Completed by:
Energy Rater: Test Rater
RESNET ID: 5459458
Rating Company: Ekotrope Rating Co.
Rating Provider: Ekotrope Provider

Test Rater, Certified Energy Rater

ekotrope

Ekotrope HERS Rating Tool - Version: 2.0.0.1590
The Home Energy Rating Standard Disclosure for this house is available from the rating provider.

~~This home meets or exceeds the criteria of the following:
Energy Star v3
Energy Star v3.1
2006 International Energy Conservation Code
2009 International Energy Conservation Code
2012 International Energy Conservation Code
2015 International Energy Conservation Code~~

Energy Rating Index (ERI)

Compliance Software Tools

Home Energy Rating Certificate

BUILD Tank

Property: Best House Ever, CO 80237
 Rater: Robby Schwarz
 Rating Date: 4/2/2021
 Certified Energy Rater: Robby Schwarz
 Rating Number: MLZVQ8L

Confirmed: - No Registry ID

HERS Index: 65

General Information

Conditioned Area: 3158 sq. ft.
 Conditioned Volume: 29733 cubic ft.
 Bedrooms: 3

Mechanical Systems Features

Heating: Fuel-fired air distribution, Natural gas, 80.0 AFUE.
 Cooling: Air conditioner, Electric, 13.0 SEER.
 Water Heating: Conventional, Natural gas, 0.61 EF, 50.0 Gal.
 Leakage to Outside: 10.00 CFM50
 Ventilation System: Exhaust Only, 75 CFM, 25.6 watts.
 Infiltration Rate: Meas-Yes, Cook-Yes

Shell Features

Ceiling Flat: R-60.0
 Slab: R-10.0 Edge, R-0.0 Under
 Exposed Floor: NA
 Window Type: U-Value: 0.300, SHGC: 0.400
 Infiltration Rate: 3.00 ACH50
 Method: Blower door

Range/Oven Fuel: Natural gas
 Clothes Dryer Fuel: Electric
 Clothes Dryer CEF: 2.62
 Ceiling Fan (cfm/Watt): 0.00

REM/Rate - Residential Energy Analysis and Rating Software v16.3.4
 does not constitute any warranty of energy costs or savings. © 1985-2022 NORESICO, Boulder, Colorado.
 The Energy Rating Standard Disclosure for this home is available from the rating provider.

Estimated Annual Energy Cost

Use	MWbtu	Cost	Percent
Heating	34.2	\$225	18%
Cooling	2.0	\$59	5%
Hot Water	15.7	\$94	8%
Lights/Appliances	23.0	\$603	49%
Photovoltaics	0.0	\$0	0%
Service Charges		\$240	20%
Total	74.9	\$1221	100%

Criteria

This home meets or exceeds the minimum criteria for the following:



REM/Rate and Ekotrope can be used to create compliance reports that meet the 2022 DEC ERI requirements

2021 IECC R-406 Projected Energy Rating Index Report

DOES NOT PASS

Property: Example House, CO 80211
 Organization: BuildTank, Inc.
 Energy Rating Information: Project Rating: 55, Rater: Robby Schwarz

Builder: Example House, CO 80211
 Address: Example House, CO 80211

Company: BuildTank, Inc.
 Phone: 303-927-0025
 Rater: Robby Schwarz

Project Rating: 55
 Rater: Robby Schwarz
 Date: 4/2/2021



Estimated Annual Energy Consumption*

	Rated Home Calculated Energy Use (MBtu)	
Heating	41.6	\$388
Cooling	2.4	\$94
Water Heating	20.5	\$480
Lights & Appliances	25.7	\$1,009
Photovoltaics	0.0	\$0
Total	90.2	\$2,635

*Based on standard operating conditions

ERI with PV:78
 ERI without PV:78

Annual Estimates

Electric (kWh): 7,776.0
 Natural Gas (Therms): 636.4
 CO2 Emissions (Tons): 11.2

Maximum Energy Rating Index: 55

This home DOES NOT MEET the Energy Rating Index of 55. It DOES NOT MEET all of the requirements of the 2nd page of this report, some of which are listed below.

Name: Robby Schwarz
 Organization: BuildTank, Inc.

The IECC ERI certificate uses the ventilation rate that is amended out of 2022 DEC

Energy Rating Index (ERI)

Compliance Report must document all inputs

HERS Reference Home Summary

Property
9446 Cherywood Trail
Littleton, CO 81611

Craig (Gordy) Gardner
Confirmed Rating

Organization
BuildTank, Inc.
Robby Schwarz
303-927-0025

Builder
Gordy Gardner

Inspection Status
Results are projected



General Building Information

Number Of Bedrooms	4
Number Of Floors	2
Conditioned Floor Area [sq. ft.]	6,516
Has Electric Vehicle Ready Space	No
Unconditioned, attached garage?	Yes
Conditioned Volume [cu. ft.]	83,237
Total Units in Building	1
Residence Type	Single family detached
Number of Floors in Building	-
Floor Number	-
Model	
Community	
RESNET/IECC 2006-2018 Climate Zone	7B
IECC 2021 Climate Zone	7B

Foundation Wall

Name	Library Type	Height Above Grade	Depth Below Grade	Perimeter	Location	Enclosing
Foundation Step	Reference	4.5	4	20	Exposed Exterior	Conditioned Space
Foundation Step	Reference	3	2.5	33	Exposed Exterior	Conditioned Space
Foundation Step	Reference	5	4.5	24	Exposed Exterior	Conditioned Space
Foundation Wall	Reference	10	9.8	71.6	Exposed Exterior	Conditioned Space
Foundation Wall Garage	Reference	10	9.5	31.5	Exposed Exterior	Conditioned Space

HERS Rated Home Summary

Property
9446 Cherywood Trail
Littleton, CO 81611

Craig (Gordy) Gardner
Confirmed Rating

Organization
BuildTank, Inc.
Robby Schwarz
303-927-0025

Builder
Gordy Gardner

Inspection Status
Results are projected



General Building Information

Number Of Bedrooms	4
Number Of Floors	2
Conditioned Floor Area [sq. ft.]	6,516
Has Electric Vehicle Ready Space	No
Unconditioned, attached garage?	Yes
Conditioned Volume [cu. ft.]	83,237
Total Units in Building	1
Residence Type	Single family detached
Number of Floors in Building	-
Floor Number	-
Model	
Community	
RESNET/IECC 2006-2018 Climate Zone	7B
IECC 2021 Climate Zone	7B

Foundation Wall

Name	Library Type	Height Above Grade	Depth Below Grade	Perimeter	Location	Enclosing
Foundation Step	1"SF R6 +BF R15 G1	4.5	4	20	Exposed Exterior	Conditioned Space
Foundation Step	1"SF R6 +BF R15 G1	3	2.5	33	Exposed Exterior	Conditioned Space
Foundation Step	1"SF R6 +BF R15 G1	5	4.5	24	Exposed Exterior	Conditioned Space
Foundation Wall	1"SF R6 +BF R15 G1	10	9.8	71.6	Exposed Exterior	Conditioned Space
Foundation Wall Garage	1"SF R6 +BF R15 G1	10	9.5	31.5	Exposed Exterior	Conditioned Space



Considerations for Existing Buildings

DEC Chapter 5 [RE]

Existing Buildings

Residential renovations can affect the energy use of the building as a whole – the DEC address such renovations in order to maintain, if not improve, the conservation of energy by the renovated or altered building

Work Category	Definition
Repair	The reconstruction or renewal of any part of an existing building for the purpose of its maintenance or to correct damage.
Alteration	Any construction, retrofit or renovation that results in a change in a building, electrical, plumbing, mechanical, or fire protection system, or an addition or change to the arrangement, type, or purpose of original installation.
Addition	An extension or increase in the conditioned space floor area, number of stories or height of a building or structure.
Change of Occupancy or Use	A change in the occupancy classification of a building or a change in the use of a building or portion of a building that involves a change in the application of the requirements of this code.

Repairs and Alterations must follow the prescriptive requirements in Chapter 5 [RE]

Considerations for Existing Building Projects

Question

Answer

Does your **project scope fall into more than one work category** (addition, alteration, repair, or change of occupancy)?

If yes, you **must follow the requirements of each applicable section.**

For additions: What is the **increase in conditioned floor area** as a percentage of the total existing above grade conditioned floor area?

Additions that **do not exceed a 20% increase or 300 sf, whichever is less**, are not required to provide air barrier details, or heating and cooling equipment sizing calculations.

Does the project qualify as a **historic building**?

If it meets one of the conditions in the code, **the historic building is exempted** from most 2022 DEC provisions.

Compliance is Simplified for Existing Homes

- Most 2022 DEC specific provisions apply only to new construction
 - Solar-ready zone and minimum onsite renewables **are not required for existing buildings**
 - Electric Vehicle (EV) charging requirements **may apply if new** garage or carport, new on-site parking space
- No electrification requirements for existing homes
 - If replacing or installing new space or water heating equipment, [consider benefits of electrifying and learn more about available programs and rebates](#)

Two Types of Additions

Changes in Space Conditioning

Unconditioned or low-energy space is changed to conditioned space



Examples: finishing an existing attic or basement, turning an unconditioned garage into a new bedroom

Total Building Performance & Energy Rating Index requirements are the same for both types of additions

All Other Additions

The addition is comprised of all new, added conditioned space



Total Building Performance

DEC Section R502.2

- **Two options** for using Total Building Performance:
 - The annual energy cost of the proposed design (addition + existing buildings) may be **110% of the annual energy cost** of the standard reference design
 - » Must also meet all required sections per Table R405.2
 - Alternatively, the annual energy cost or energy use of the addition and the existing building, and any alterations that are part of the project, **must be less than or equal to the annual energy cost of the existing building**
 - » The addition and any alterations that are part of the project shall comply with Section R405 in its entirety (*includes R402.4.1.2 Testing*)

Energy Rating Index (ERI)

DEC Specific
Amendment

DEC Section R502.2

- When using the Energy Rating Index compliance option, the ERI of the addition and the existing building, and any alterations that are part of the project, **must be less than or equal to the ERI of the existing building**
 - » The addition and any alterations that are part of the project shall comply with Section R406 in its entirety (*includes R402.4.1.2 Testing*)

Alterations & Repairs

- Alterations and Repairs must meet the **prescriptive requirements** outlined in DEC Sections R503 and R504, respectively
 - » *See previous training in series on Prescriptive Compliance*



Change of Occupancy or Use

DEC Specific
Amendment

DEC Section R505.1: A project with a change or occupancy or use to residential must meet the applicable requirements of Chapter 5 [RE] for additions, alterations, and repairs

- If changing **from a lower energy-demand category** (*IBC occupancies F, H, or S*), must meet all requirements for new construction, unless change does not result in increased energy demand
- **Exception for Total Building Performance:** The annual energy cost of the proposed design may be up to **110%** of the standard reference design
- No exceptions for Energy Rating Index (*must meet maximum ERI in R406*)

Existing Home Support and Resources

www.denvergov.org/HomeEnergy

- Resources for:
 - Rebates for existing homes
 - How to electrify your home and work with contractors
 - Income Qualified Rebates

www.denvergov.org/CAREContractorResources

- Resources for:
 - Instructions for Installers Applying for Rebates



Space Heating and Cooling

Heating and cooling account for the majority of energy we use in our homes. As the grid moves to 100% renewable power, electric appliances like heat pumps are the clear path to reducing carbon emissions generated by our homes.



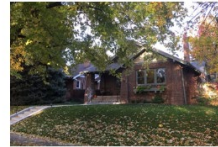
Water Heating

Your water heater might not be the first thing you think of when changing your home appliances to electric. But it can be a great place to try a heat pump and improve efficiency and indoor air quality!



Home Solar

Adding solar to your home or subscribing to a solar co-op is a great way to save money on your utilities bills and reduce carbon emissions from your house. Learn about all the ways we can help you become a solar household as well!



Income Qualified Rebates

Qualified households are eligible for additional rebates and incentives to offset the costs of equipment upgrades. Learn whether you might qualify, and find out how to work with our partners at Energy Resource Center to start saving.



Healthy Homes Program

The Healthy Homes Program will provide extensive home energy and weatherization upgrades for income qualified homes where someone in the household also has a respiratory condition. If you think you might qualify, reach out to our program partners.



Electric Vehicles

Electrifying your home includes more than just the house itself. Your transportation can also be electrified, which improves our city's air quality and eliminates expensive trips to the gas station. Learn about the other benefits of electric vehicles and how you can save money when you purchase one.

How is electrification in existing buildings going for you?

CASR's existing building electrification team would love to hear stories and feedback from contractors and building professionals about how heat pump installation is going for you!

If you'd like to share your experience with CASR email electrification@denvergov.org

Summary

Both the Total Building Performance and Energy Rating Index compliance options utilize **whole-building energy modeling that allows for tradeoffs**

- All-electric properties have an easier path to compliance under both options

In addition to performance requirements, projects must **meet all required prescriptive provisions** outlined in DEC Tables R405.2 or R406.2

- Additional Efficiency Packages (DEC R408) are NOT required

DEC allows **relaxed performance requirements for additions** to existing homes and changes of occupancy or use projects

Questions?

- Please use the Q&A feature to submit your questions



- Responses to all questions not addressed today will be sent out by email to registered participants
- Additional questions may be sent to: energy.review@denvergov.org

Thank you!

For more information, visit:

[Denvergov.org/EnergyCode](https://denvergov.org/EnergyCode)

[Denvergov.org/BuildingCode](https://denvergov.org/BuildingCode)

Contact us:

Questions about code: energy.review@denvergov.org

Questions about programs & resources: sustainability@denvergov.org