

CAPCOG & SPEER

Building Energy Codes Workshop



Agenda

Breakfast & Networking

Introduction by CAPCOG & SPEER

- **Randy Plumlee, SPEER**
- **Ramon Zarate, CAPCOG**

CAPCOG – Air Quality & Energy

- **Ramon Zarate, CAPCOG**

**SPEER – IECC, RES*check* and COM*check*
Overview and Training**

- **Randy Plumlee, SPEER**

Open Discussion

Closing Remarks

- **Randy Plumlee, SPEER**
- **Ramon Zarate, CAPCOG**



Housekeeping



Presentations will be shared



Restrooms & Water



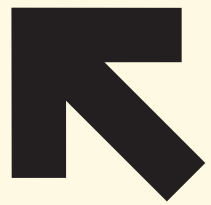
Emergency Exits



Phones - step outside if needed



Take breaks as needed



Introductions

Please add your Name, Organization, and Role in the chat



Air Quality & Energy

Building Energy Code Workshop

Ramon Zarate

April 8, 2026

CAPCOG – Regional Planning Commission in Statute; more often called a COG.



- Emergency Communications 9-1-1
- Area Agency on Aging/Aging & Disability Resource Center
- Homeland Security Planning & Training
- Regional Law Enforcement Academy
- **Air Quality Planning**
- Solid Waste Planning
- Economic Development Analysis & Technical Assistance
- Transportation Planning



The Clean Air Act



The Clean Air Act imposes various requirements and restrictions to protect air quality

National Ambient Air Quality Standards (NAAQS)

- Set by the **Environmental protection Agency (EPA)**
- Standards for **maximum allowable pollution** levels for six common pollutants
- CO, NO_x, O₃, PM, Pb, and SO₂
- Types of standards for ambient air quality
 - **Primary standards**- protecting public health
 - **Secondary Standards**- promotion of public welfare

Areas violating these standards or contributing to a violation nearby are designated “**nonattainment**”



Central Texas Clean Air Coalition (CAC)



A national leader in pro-active, voluntary efforts to improve air quality and stay in attainment of the standards

Goals: maintaining compliance with the NAAQS, improve air quality, provide guidance

Regular members: Cities and Counties that have made commitments and appointed an elected official to represent them

Supporting members: any type of organization that supports the purpose of the CAC that wishes to participate

CAPCOG's Air Quality Program



- **Organize Clean Air Coalition (CAC)** and the Advisory Committee (CACAC)
- **Monitoring air quality** in region
- Provide **technical assistance** to CAC members
 - Technical reports (**Annual Report, Data Analysis**)
- Perform **Studies and Planning Activities**
 - Emissions and Control Strategies (In partnership with **EPA** and **TCEQ**)
- **Outreach and Education Activities**
 - Provide the public with information about Central Texas Air Quality

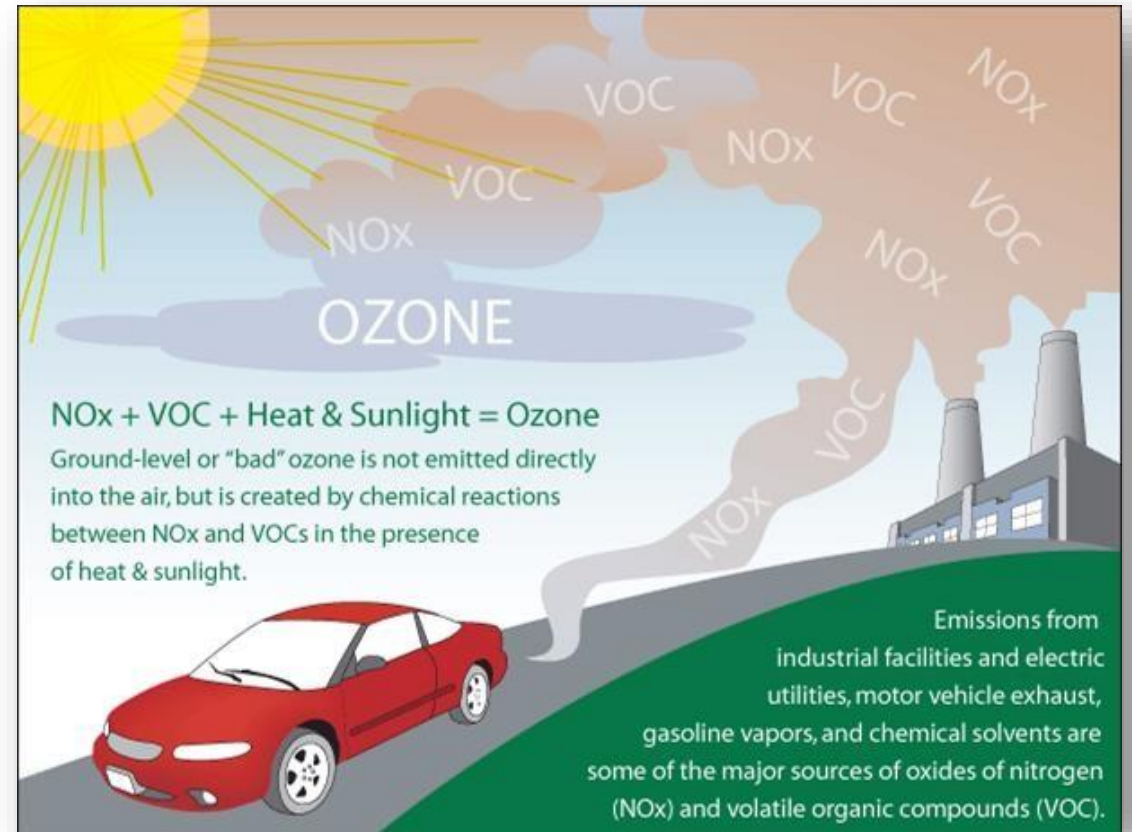


Ground-Level Ozone (O_3)

Ground-Level Ozone is a powerful greenhouse gas and air pollutant harmful to human health, agriculture crops and ecosystems.

Not emitted directly into the air but is created by photo-chemical reactions between different pollutants:

Nitrogen Oxides (NO_x) + Volatile Organic Compounds (VOC) + Sunlight = O_3



<https://www.epa.gov/ground-level-ozone-pollution/ground-level-ozone-basics>

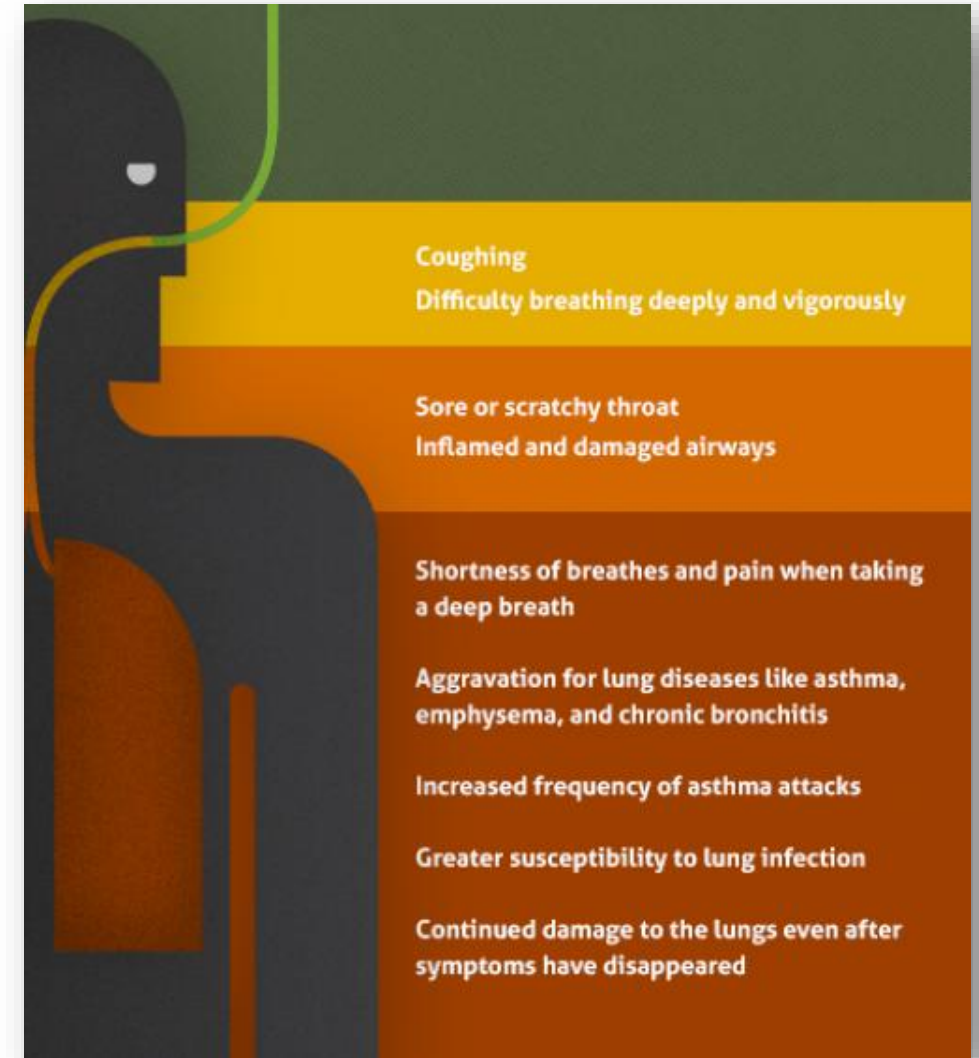
Health Effects of O₃ Exposure



When **inhaled**, ozone can **irritate the respiratory system** and **cause a variety of health problems**, including:

- Coughing,
- Chest pain, and
- Shortness of breath
- Exacerbate existing respiratory conditions (asthma and chronic obstructive pulmonary disease)

Some studies have suggested that ozone may weaken the immune system and increase the risk of respiratory infections



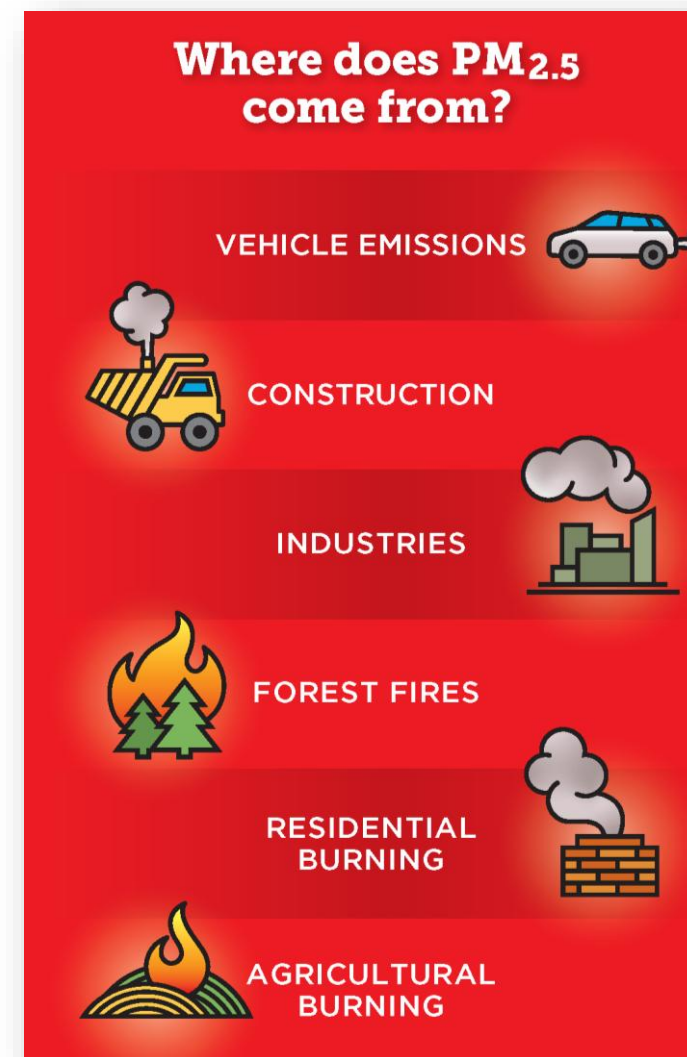
Particulate Matter (PM)



Particulate matter is a mixture of particles and droplets found in the air. Particle types includes:

- **Course PM (PM_{10})** : inhalable particles, with diameters that are generally 10 micrometers and smaller
- **Fine PM ($PM_{2.5}$)** : inhalable particles, with diameters that are generally 2.5 micrometers and smaller.

While most are so small that they can only be detected using a microscope, large quantities can become dark enough to be seen with the naked eye.



Health Effects of PM_{2.5} Exposure



How can PM_{2.5} affect my health?

DECREASED
LUNG FUNCTION



ASTHMA ATTACKS
& BRONCHITIS

IRREGULAR
HEARTBEATS



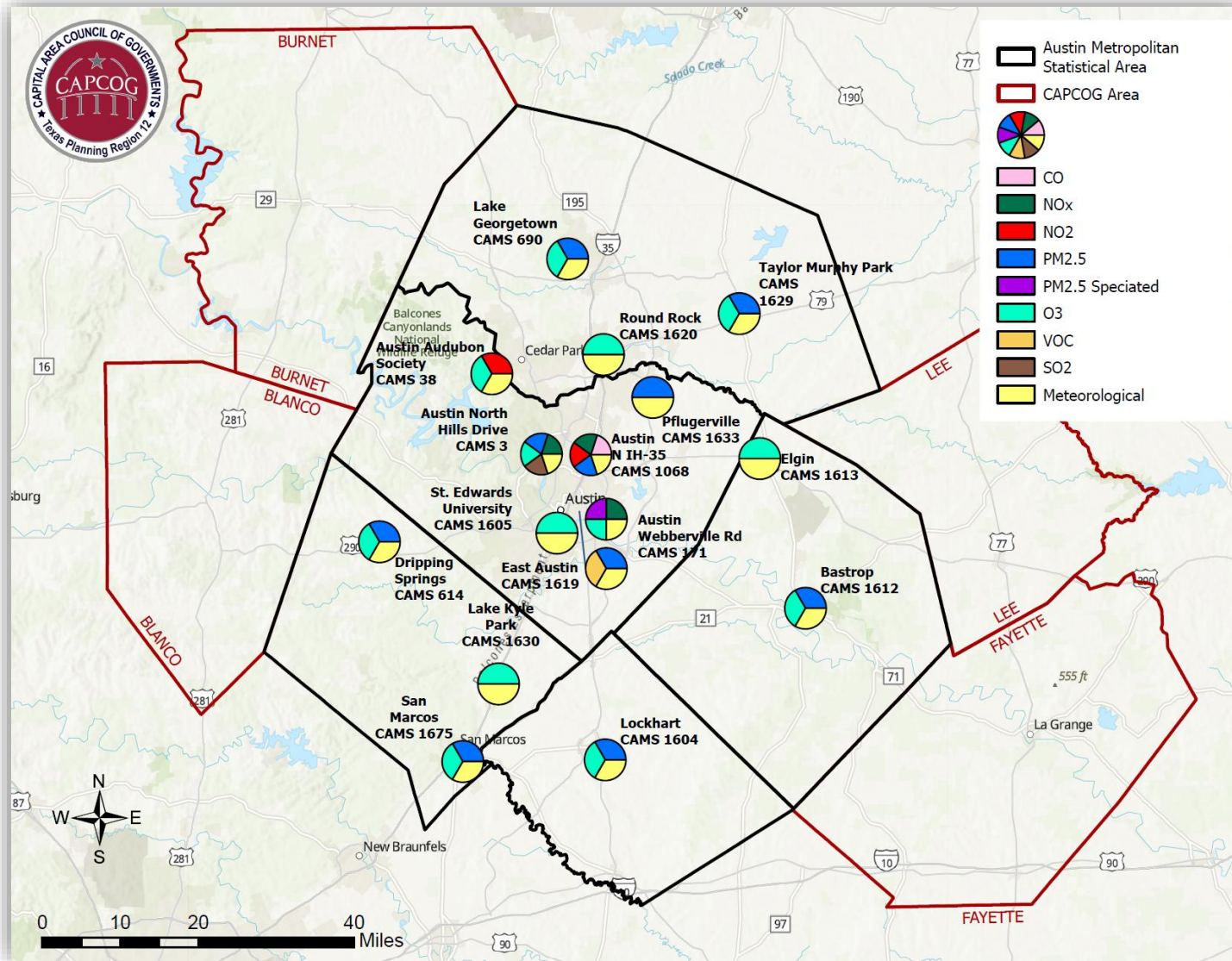
HEART ATTACKS

EXACERBATES
PRE-EXISTING HEALTH
CONDITIONS



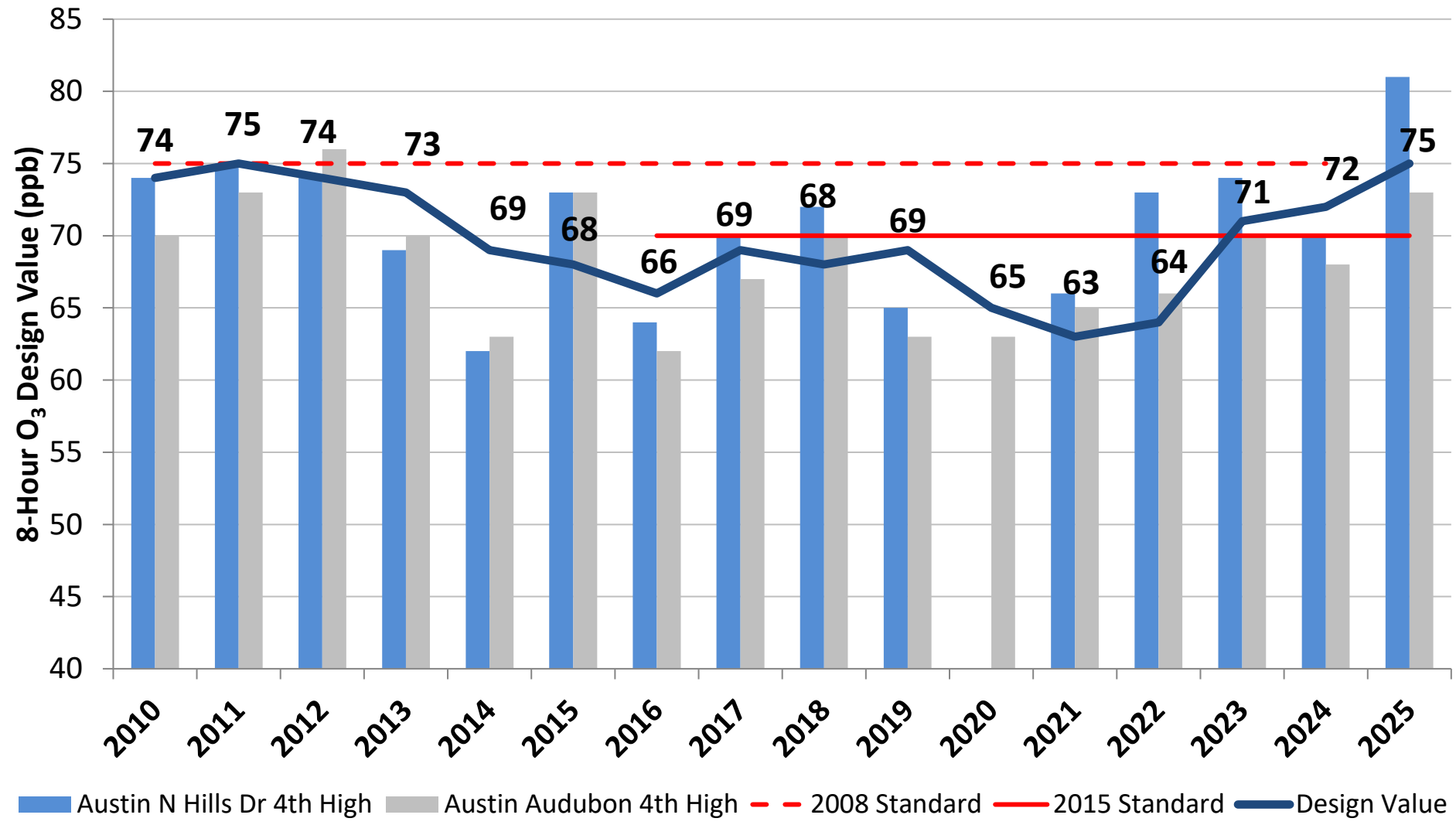
- **Health Effects of PM_{2.5} exposure** include:
 - Irritation of the airways
 - Coughing or difficulty breathing
 - Aggravated asthma
 - Decreased lung function
 - Heart attacks
 - Cancer
 - Mortality

2026 Austin MSA Monitors



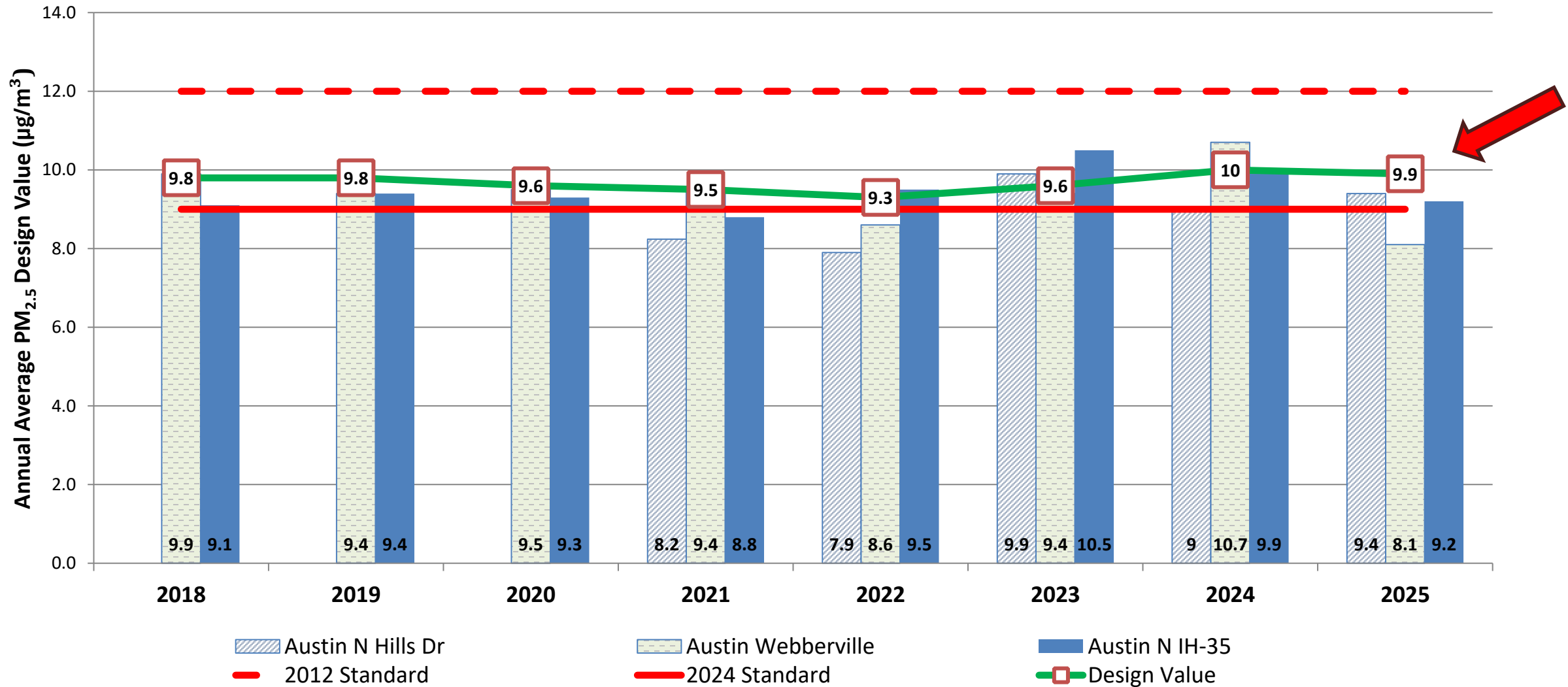
- **TCEQ**
 - 4 monitoring sites
- **CAPCOG**
 - 11 monitoring sites
- **St. Edward's University**
 - 1 monitoring site

8-hr. Ozone Design Value and 4th High Trend



*Data subject to change

Annual PM_{2.5} Design Value Trend



*Data subject to change

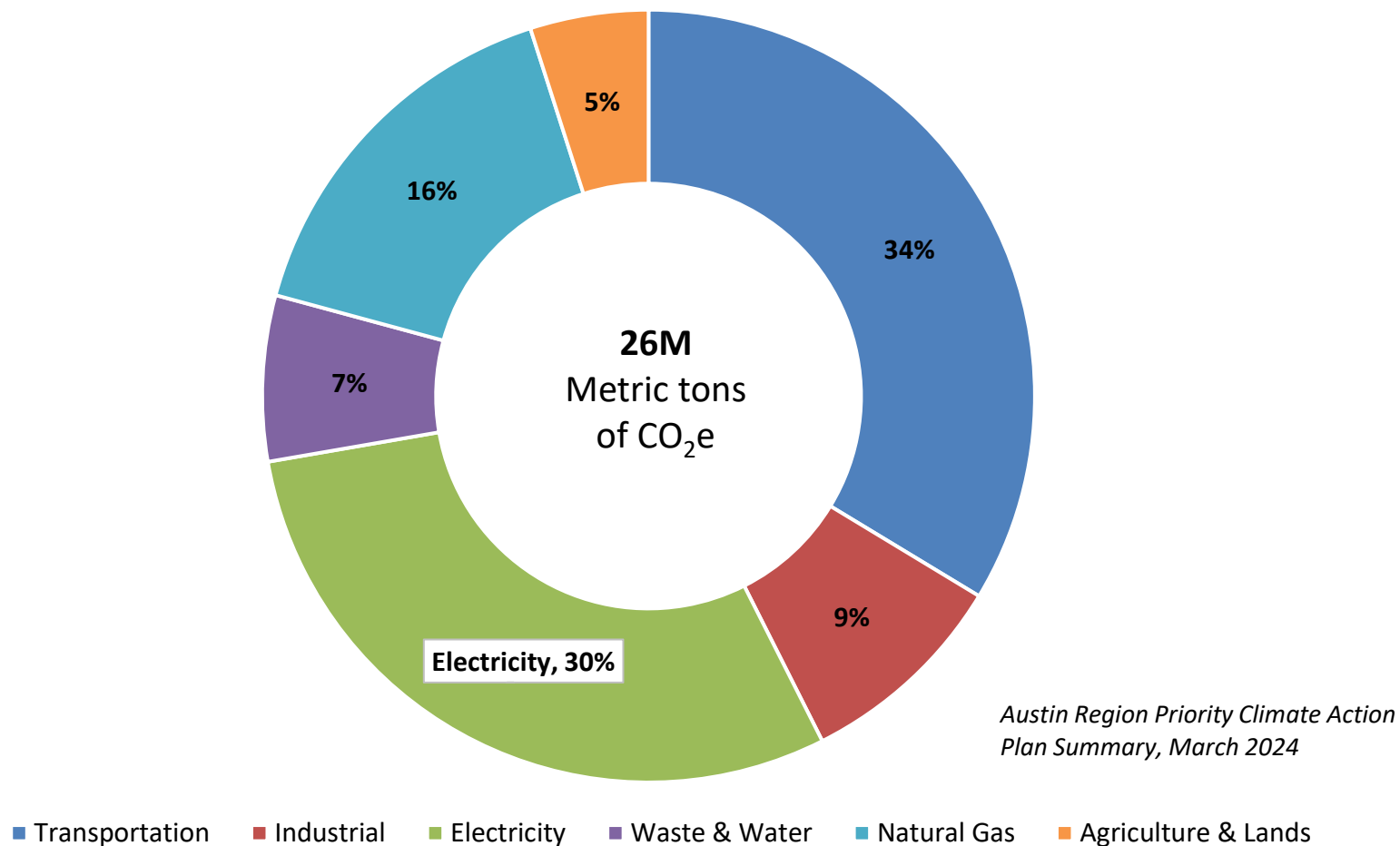
Energy & Air Quality



- Energy generated from fossil fuels contribute to PM, NO_x, & greenhouse gas emissions
- Implementing energy efficiency upgrades lowers overall energy demand, reducing emissions
- Efficiency upgrades also help **local governments & organizations** work toward climate and air quality goals



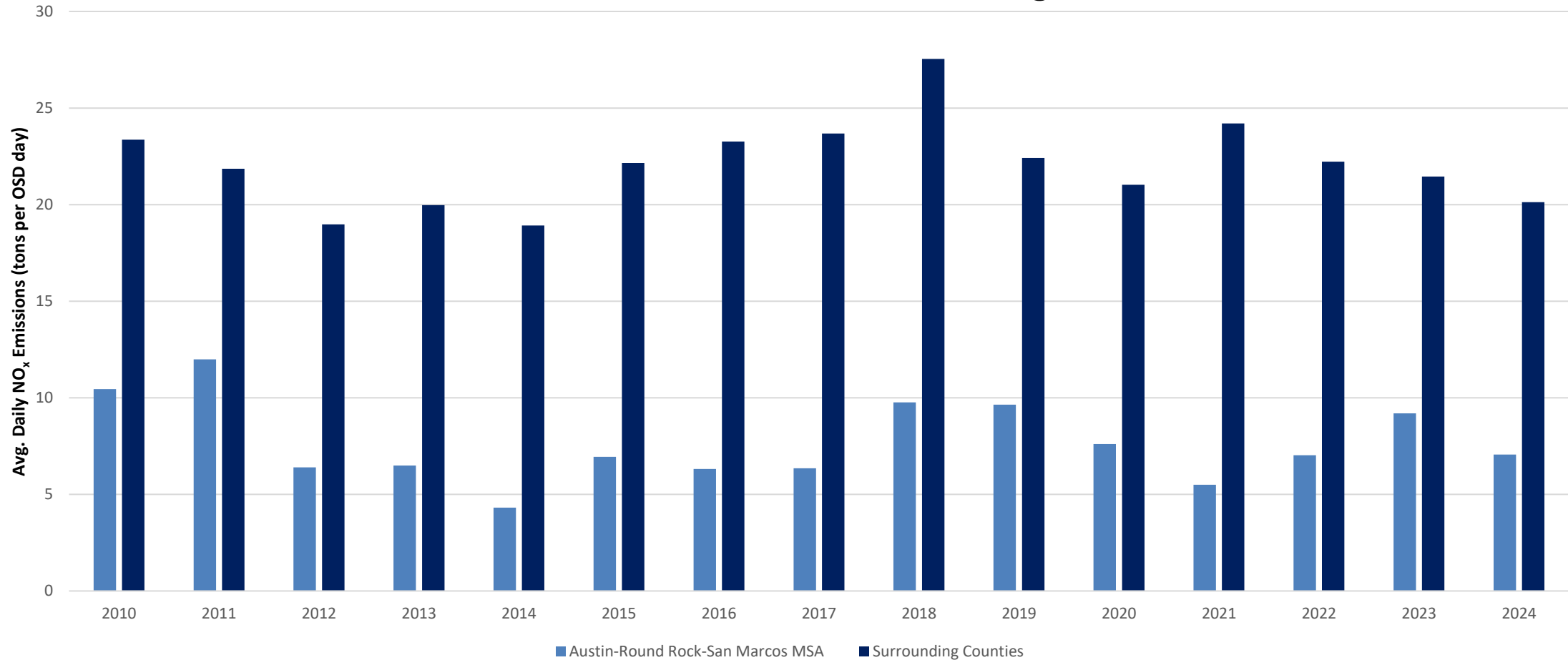
Regional Inventory of Greenhouse Gases



Regional Electric Generating Unit (EGU) NO_x Emissions



Average Daily May – September NO_x Emissions from EGU Point Sources in Austin-Round Rock-San Marcos MSA and Surrounding Counties, 2010-2024



CAPCOG Awarded \$250k for Energy & Water Conservation Efforts by SECO



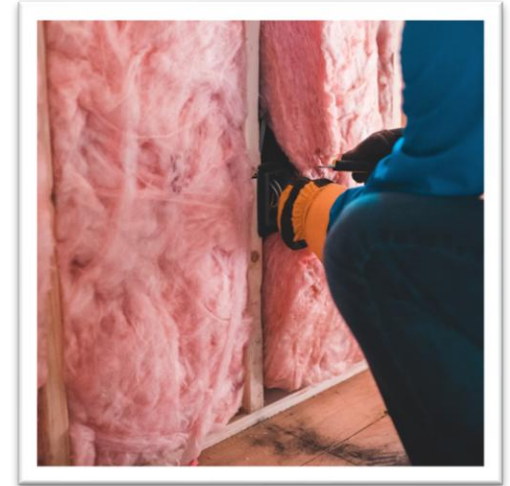
- Identifying regional energy management interests, needs, and priorities
- Organizing/hosting four workshops addressing energy/water management
- Creating energy/water conservation web page
- Provide technical assistance to local governments for energy/water reporting and data-collection goals

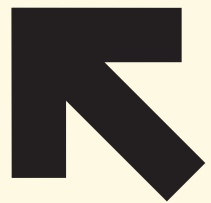


Funding Sources for Energy Improvements



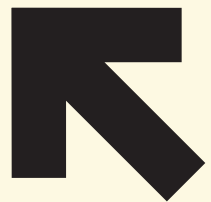
- [Property Assessed Clean Energy \(TX-PACE\)](#) – Finances permanent improvements intended to decrease water or energy consumption or demand
- [Energy Efficiency and Conservation Block Grant \(EECBG\)](#) – finances improvements for state/local govt's to reduce energy use & improve energy efficiency
- [LoanSTAR Program](#) – provides low-interest loans to fund energy-related, cost reduction retrofit projects
- [Texas Emission Reduction Plan \(TERP\)](#) – provides funding to cut NO_x emissions by upgrading vehicles and equipment





Randy Plumlee
Senior Manager, Building
Performance





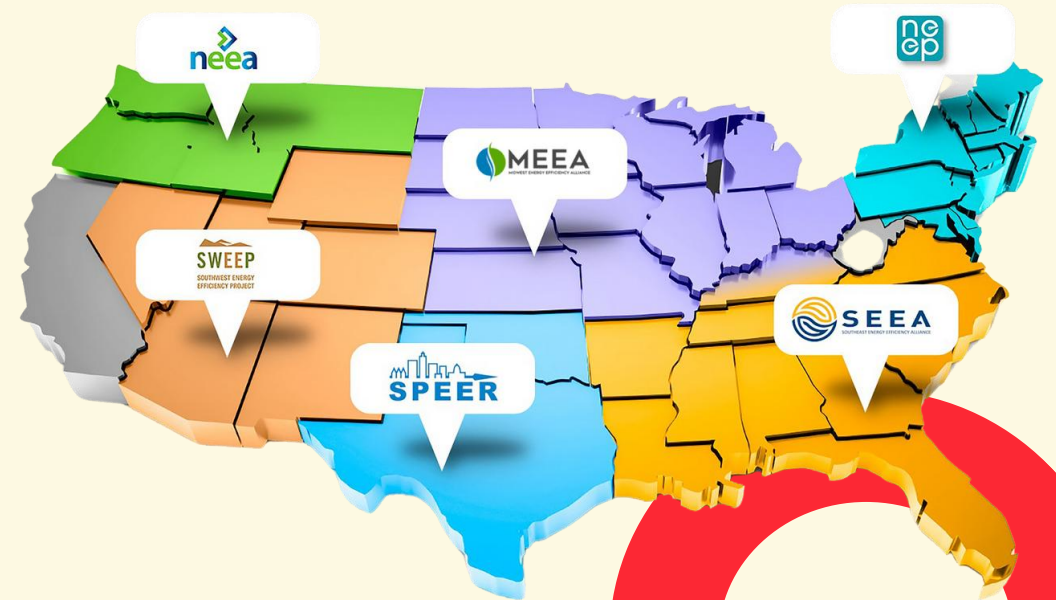
2024 IECC, RES*check* and COM*check* Overview and Training for CAPCOG

Randy Plumlee / 4.08.26



Who is SPEER?

- **REEO: Regional Energy Efficiency Organization**
- **Member-based, non-profit 501(c)3 organization**
- **65+ members from a wide cross section of Energy Efficiency Industries**
- **Focused on Outreach Education and Collaboration on Clean Energy**





Residential and Commercial



Estimated Improvement in Residential & Commercial Energy Codes (1975 - 2021)





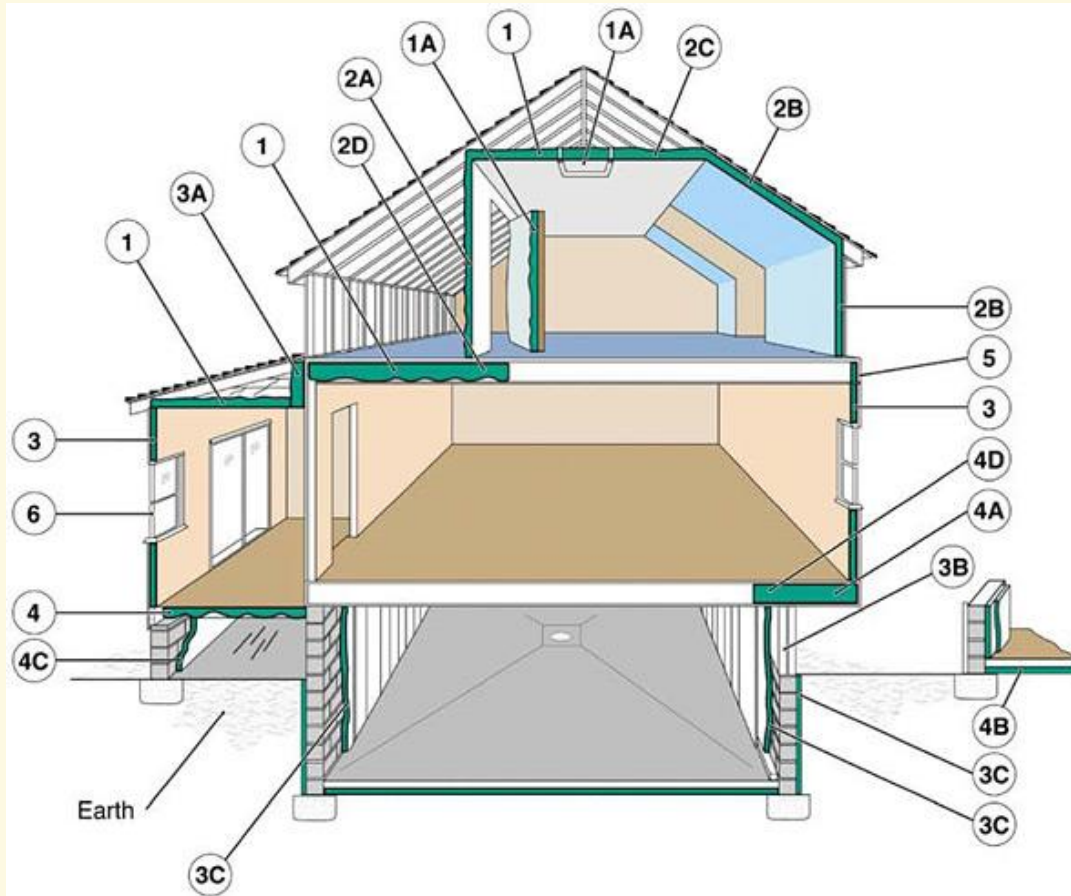
Energy Modeling 101

Main Goal and Objective:

- **To provide a simple, standardized way to demonstrate compliance with energy codes (IECC / ASHRAE 90.1) without requiring full energy modeling**
- **RES*check*: low-rise residential buildings (IRC / IECC)**
 - **Moderate trade-offs (TC... aka UA)**
- **COM*check*: any building that's NOT residential**
 - **Limited (no cross-tradeoffs)**



REScheck 101

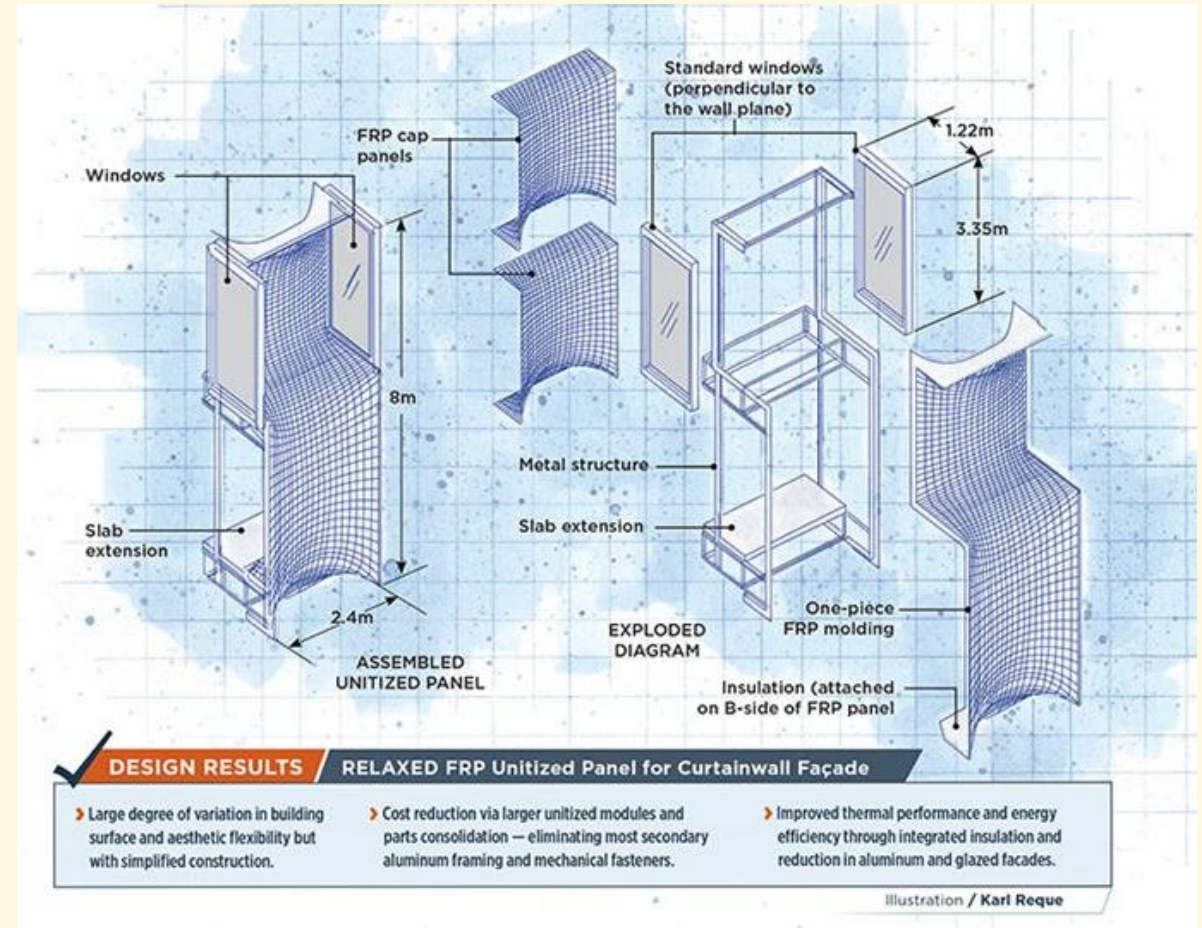


- **Applies To:**
 - Low-rise residential (1-3 stories)
 - Single-family homes
 - Townhomes
- **Focus:**
 - Building envelope **ONLY**
 - Insulation (walls, attic, floors)
 - Windows (U-factor, SHGC)
- **Flexibility:**
 - Allows UA trade-offs
 - Better windows for less insulation
 - More insulation for more windows



COMcheck 101

- **Applies to:**
 - **Commercial Buildings**
 - **High-rise residential**
- **Focus:**
 - **Building Envelope**
 - **Lighting Systems**
 - **Mechanical (HVAC)**
- **Flexibility:**
 - **NO cross-system trade-offs**
 - **Envelope must pass alone**
 - **Lighting must pass alone**
 - **Mechanical must pass alone**
 - **Envelope UA trade-offs allowed**





Comparison – RES vs COM



Side-by-Side Comparison

Feature

 REScheck

 COMcheck

Building Type

Residential

Commercial + High-rise res

Systems Covered

Envelope only

Envelope + Lighting + HVAC

Trade-Offs Allowed

Yes (Envelope UA)

Limited (Envelope only)

Cross-System Tradeoff

N/A

 Not allowed

Complexity Level

Simple

Moderate

Main Users

Builders, Raters

Designers, Engineers, Officials



REScheck



REScheckTM



You need Software!!

Prescriptive – Total UA



Performance R405



REM/*Rate*TM

Energy Rating Index R406





Verifying Compliance

- **Review building plans to ensure all components are entered correctly**
- **Confirm takeoffs (areas) are correct**
- **Confirm insulation values**
 - **Double check cavity vs. continuous entries**
- **Confirm fenestration values**
 - **Double check ratings on windows and doors (U-factor and SHGC)**
- **Compare proposed U-factors with required U-factors**
- **Evaluate UA data is correct**



Evaluate Assembly Performance

TABLE R402.1.4
EQUIVALENT *U*-FACTORS^a

CLIMATE ZONE	FENESTRATION <i>U</i> -FACTOR	SKYLIGHT <i>U</i> -FACTOR	CEILING <i>U</i> -FACTOR	FRAME WALL <i>U</i> -FACTOR	MASS WALL <i>U</i> -FACTOR ^b	FLOOR <i>U</i> -FACTOR	BASEMENT WALL <i>U</i> -FACTOR	CRAWL SPACE WALL <i>U</i> -FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.030	0.084	0.165	0.064	0.360	0.477
3	0.35	0.55	0.030	0.060	0.098	0.047	0.091 ^c	0.136
4 except Marine	0.35	0.55	0.026	0.060	0.098	0.047	0.059	0.065
5 and Marine 4	0.32	0.55	0.026	0.060	0.082	0.033	0.050	0.055
6	0.32	0.55	0.026	0.045	0.060	0.033	0.050	0.055
7 and 8	0.32	0.55	0.026	0.045	0.057	0.028	0.050	0.055

+ ✎ □ ×	Wall	Wood Frame, 16" o.c.	1000	Unspecified	19	5	0.045	+ ✎ □ ×
+ ✎ □ ×	Wall 1	Wood Frame, 24" o.c.	1000	Unspecified	19	5	0.044	+ ✎ □ ×
+ ✎ □ ×	Wall 2	Steel Frame, 16" o.c.	1000	Unspecified	19	5	0.071	+ ✎ □ ×
+ ✎ □ ×	Wall 3	Steel Frame, 24" o.c.	1000	Unspecified	19	5	0.064	+ ✎ □ ×



Reports

Reports – Sample Compliance Certificate



Generated by REScheck-Web Software

Compliance Certificate

Project A Sample Project

Energy Code: **2018 IECC**
Location: **Eugene, Oregon**
Construction Type: **Single-family**
Project Type: **New Construction**
Orientation: **Bldg. faces 180 deg. from North**
Conditioned Floor Area: **3,000 ft²**
Glazing Area: **2%**
Climate Zone: **4 (4546 HDD)**
Permit Date:
Permit Number:

Construction Site:
123 Main St.
Dogtown, WA 99352

Owner/Agent:
R. Franklin
321 W. Tenth
Dogtown, WA 99532
509.888.7777

Designer/Contractor:
Anne Hatchet
Acme Home Designers
555 Paire Ridge
Dogtown, WA 99532
509.888.999

Verify energy
code, location,
construction
type, and
conditioned
floor area

Compliance: Passes using UA trade-off

Compliance: **17.8% Better Than Code** Maximum UA: **545** Your UA: **448**

The % Better or Worse Than Code Index reflects how close to compliance the house is based on code trade-off rules.
It DOES NOT provide an estimate of energy use or cost relative to a minimum-code home.

- **Compliance certificate is your official documentation**
- **Verify project into (code, climate zone, building type, area)**
- **Confirm UA (TC) results and pass/fail status**
- **Used for plan review, permitting, and inspections**



Envelope Assembly Table

Envelope Assemblies

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Prop. U-Factor	Req. U-Factor	Prop. UA	Req. UA
my Ceiling: Flat Ceiling or Scissor Truss	3,000	41.0	0.0	0.029	0.026	86	77
mySkylight: Metal Frame	20			0.500	0.550	10	11
Wall 1: Wood Frame, 24" o.c. Orientation: Front	1,200	21.0	5.0	0.042	0.060	50	72
Wall 2: Wood Frame, 24" o.c. Orientation: Front	1,200	21.0	5.0	0.042	0.060	48	69
Window 1: Metal Frame Orientation: Front	16			0.250	0.300	4	5
Window 2: Metal Frame Orientation: Front	16			0.250	0.300	4	5



Envelope Assembly Table

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Prop. U-Factor	Req. U-Factor	Prop. UA	Req. UA
Basement: Solid Co Orientation: Unsp Wall height: 8.0' Depth below grad Insulation depth: 7	1,000	0.0	15.0	0.050	0.050	50	50

Verify
Compliance
Statement is
Signed

Verify Values are
Consistent with
Plans

Compliance Statement: The proposed building design described here is consistent with the building plans, specifications, calculations submitted with the permit application. The proposed building has been designed to meet the 2018 IECC requirements. REScheck Version : REScheck-Web and to comply with the mandatory requirements listed in the REScheck Inspection Checklist.

Name - Title

Signature

Date



REScheck Compliance Report



Generated by REScheck-Web Software Compliance Certificate

Project Test House 1

Energy Code: **2021 IECC**
Location: **Rowlett, Texas**
Construction Type: **Single-family**
Project Type: **New Construction**
Orientation: **Bldg. faces 270 deg. from North**
Conditioned Floor Area: **1,404 ft²**
Glazing Area: **16%**
Climate Zone: **2 (2701 HDD)**
Permit Date:
Permit Number:

Construction Site: Owner/Agent: Designer/Contractor:
Test Street
Rowlett, TX 75089

Compliance: Fails using performance alternative

Compliance: **5.9% Worse Than Code**

Slab-on-grade tradeoffs are no longer considered in the UA or performance compliance path in REScheck. Each slab-on-grade assembly in the specified climate zone must meet the minimum energy code insulation R-value and depth requirements.

Envelope Assemblies

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Prop. U-Factor	Req. U-Factor	Prop. UA	Req. UA
Ceiling: Flat Ceiling or Scissor Truss	1,000	49.0	0.0	0.026	0.026	26	26
Ceiling 1: Cathedral Ceiling	404	22.0	0.0	0.046	0.026	19	11
Wall 1: Wood Frame, 16" o.c. Orientation: Front	345	13.0	0.0	0.082	0.084	17	17
Door 2: Solid Door (under 50% glazing) Orientation: Front	21			0.650	0.400	14	8
Window 1: Metal Frame SHGC: 0.25 Orientation: Front	120			0.400	0.400	48	48
Wall 2: Wood Frame, 16" o.c. Orientation: Right side	540	13.0	0.0	0.082	0.084	40	41
Window 2: Metal Frame SHGC: 0.25 Orientation: Right side	50			0.400	0.400	20	20
Wall 3: Wood Frame, 16" o.c. Orientation: Back	345	13.0	0.0	0.082	0.084	22	22
Door 3: Solid Door (under 50% glazing) Orientation: Back	21			0.500	0.400	11	8
Window 3: Metal Frame SHGC: 0.25 Orientation: Back	60			0.400	0.400	24	24

Project Title: Test House 1
Data filename:

Report date: 10/28/23
Page 1 of 10

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Prop. U-Factor	Req. U-Factor	Prop. UA	Req. UA
Wall 4: Wood Frame, 16" o.c. Orientation: Left side	540	13.0	0.0	0.082	0.084	40	40
Door 3: Glass Door (over 50% glazing) SHGC: 0.25 Orientation: Left side	18			0.400	0.400	7	7
Window 4: Metal Frame SHGC: 0.25 Orientation: Left side	40			0.400	0.400	16	16
Floor: Slab-On-Grade (Unheated) Insulation depth: 0.0' Insulation position: Horizontal Insulation	1,500		0.0	0.730	0.730	0	0

Mechanical Equipment

Description	Fuel type	Efficiency
Furnace		80 AFUE
Air Conditioner		17 SEER

Additional Efficiency Package(s)

Required: 0 Proposed: 0

Project Title: Test House 1
Data filename:

Report date: 10/28/23
Page 2 of 10

- **Projected vs. Final**
- **Projected = plan review and design phase**
- **Final = field verification and as-built conditions**
- **Both must align with code and documentation**



Inspection Checklist

- Ties plans to field verification
- Confirms mandatory IECC requirements
- Tracks plan review vs. field inspection
- Documents compliance, deficiencies, and notes



REScheck Software Version : REScheck-Web

Inspection Checklist

Energy Code: 2021 IECC

Requirements: 100.0% were addressed directly in the REScheck software

Text in the "Comments/Assumptions" column is provided by the user in the REScheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req.ID	Pre-Inspection/Plan Review	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
103.1, 103.2 [PR1] ¹	Construction drawings and documentation demonstrate energy code compliance for the building envelope. Thermal envelope and energy compliance path represented on construction documents.			☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	Requirement will be met.
103.1, 103.2, 403.8 [PR3] ¹	Construction drawings and documentation demonstrate energy code compliance for lighting and mechanical systems. Systems serving multiple dwelling units must demonstrate compliance with the IECC Commercial Provisions.			☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	Requirement will be met.
302.1, 403.7 [PR2] ²	Heating and cooling equipment is sized per ACCA Manual S based on loads calculated per ACCA Manual J or other methods approved by the code official.	Heating: Btu/hr _____ Cooling: Btu/hr _____	Heating: Btu/hr _____ Cooling: Btu/hr _____	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	Requirement will be met.

Additional Comments/Assumptions:



Efficiency Certificate

- **Required IECC certificate (to be posted in the home)**
- **Summarizes all efficiency measures met code requirement**
- **Must match final / as-built conditions**
- **Used by inspectors, appraisers, and homeowners**



2021 IECC Energy Efficiency Certificate

Insulation Rating	R-Value
Above-Grade Wall	13.00
Below-Grade Wall	0.00
Floor	0.00
Ceiling / Roof	49.00
Ductwork (unconditioned spaces):	_____

Glass & Door Rating	U-Factor	SHGC
Window	0.40	0.25
Door	0.65	0.25

Heating & Cooling Equipment	Efficiency
Furnace	80 AFUE
Air Conditioner	17 SEER
Water Heater: _____	_____

Name: _____ Date: _____

Comments _____



R107.2 – Required Inspections



- Footing and foundation inspection
- Framing and air barrier rough-in inspection
- Plumbing rough-in inspection
- Mechanical rough-in inspection
- Electrical rough-in inspection
- Insulation and fenestration rough-in inspection
- Final inspection

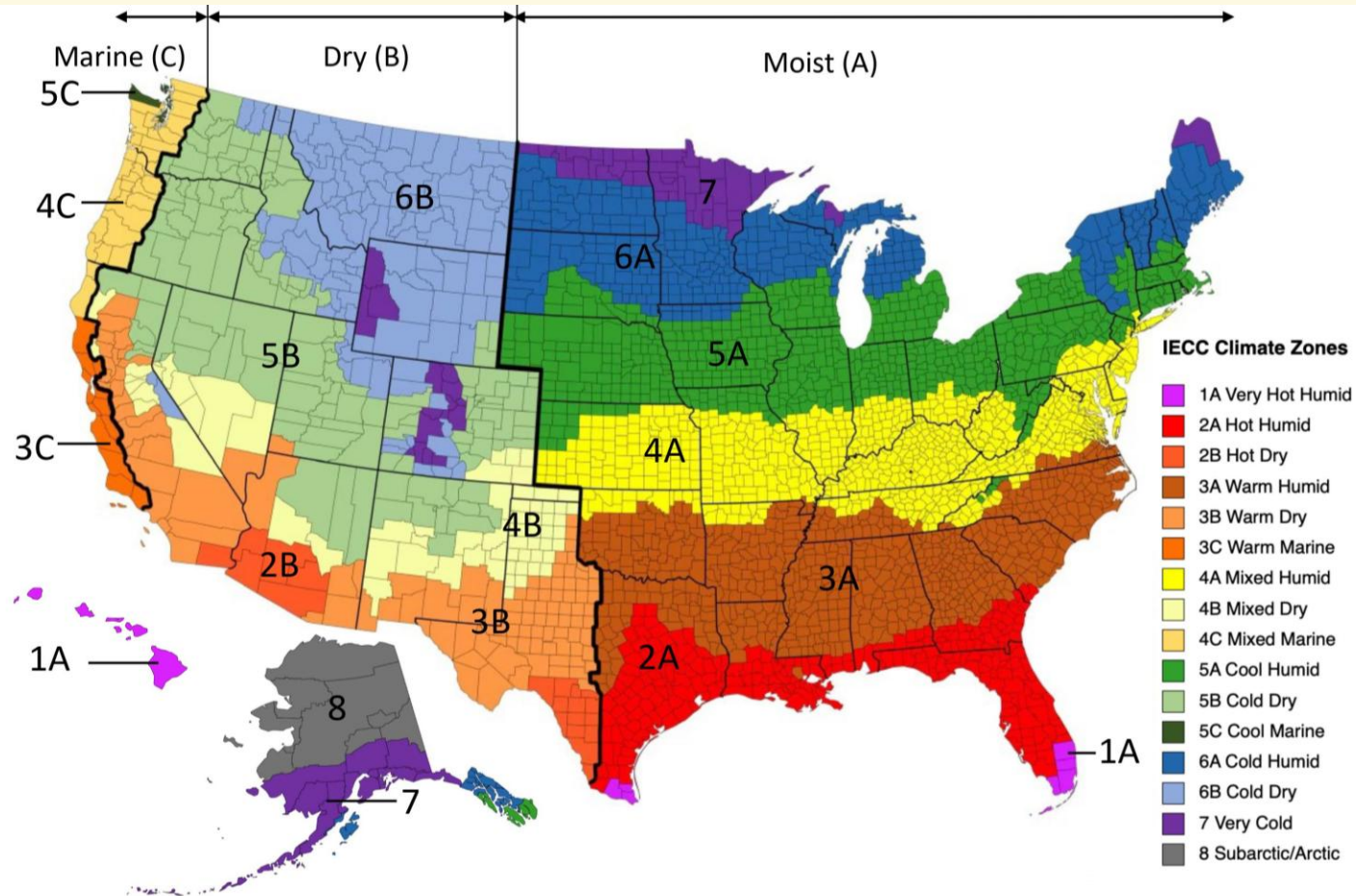


R107.4 – Approved third-party inspections agencies

- **R107.4 – Third-Party Inspection Agencies**
 - **Code Official Authority given to 3rd-party**
 - May accept reports from approved 3rd-party agencies
 - Agencies must be approved for qualifications before permit issuance
- **R107.4.1 – Authorization**
 - Agencies must provide requested information to demonstrate compliance (Certs)
- **R107.4.1.1 – Independence**
 - Must be independent from building design or construction
 - Perform duties only within delegated scope
 - Must disclose conflicts of interest
- **R107.4.1.2 – Equipment**
 - Must have adequate and calibrated equipment for required inspections and tests
- **R107.4.1.3 – Personnel**
 - Inspectors must be trained or credentialed
 - Documentation of qualifications must be available to the code official
- **R107.4.1.4 – Delegated Authority**
 - Authorized to perform delegated inspections
 - Determine compliance or noncompliance with approved construction documents
- **R107.4.2 – Reporting**
 - Must keep records of inspections and tests
 - Submit reports to code official and owner or representative
 - Reports must confirm compliance, note deficiencies, and document corrections
- **Defines criteria for third-party inspection agencies**
- **Agencies must be independent (not affiliated with the construction/design of the project)**
- **Agencies must have adequate equipment, trained personnel and credentials to perform inspections and testing**
- **Supports inspector quality and reliability in verifying key energy-code measures**



CZ Map Updated in 2021





R402.1.2 U-Factor Table

TABLE R402.1.2 MAXIMUM ASSEMBLY U-FACTORS^a AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	0	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7 AND 8
Vertical fenestration U-factor	0.50	0.50	0.40	0.30	0.30	0.28 ^d	0.28 ^d	0.27 ^d
Skylight U-factor	0.60	0.60	0.60	0.53	0.53	0.50	0.50	0.50
Glazed vertical fenestration SHGC	0.25	0.25	0.25	0.25	0.40	NR	NR	NR
Skylight SHGC	0.28	0.28	0.28	0.28	0.40	NR	NR	NR
Ceiling U-factor	0.035	0.035	0.030	0.030	0.026	0.026	0.026	0.026
Insulation entirely above roof deck	0.039	0.039	0.039	0.039	0.032	0.032	0.032	0.028
Wood-framed wall U-factor	0.084	0.084	0.084	0.060	0.045	0.045	0.045	0.045
Mass wall U-factor ^b	0.197	0.197	0.165	0.098	0.098	0.082	0.060	0.057
Floor U-factor	0.064	0.064	0.064	0.047	0.047	0.033	0.033	0.028
Basement wall U-factor	0.360	0.360	0.360	0.091 ^c	0.059	0.050	0.050	0.050
Unheated slab F-factor ^e	0.73	0.73	0.73	0.54	0.51	0.51	0.48	0.48
Heated slab F-factor ^e	0.74	0.74	0.74	0.66	0.66	0.66	0.66	0.66
Crawl space wall U-factor	0.477	0.477	0.477	0.136	0.065	0.055	0.055	0.055

For SI: 1 foot = 304.8 mm.

- Nonfenestration U-factors and F-factors shall be obtained from measurement, calculation, an approved source, or Appendix RF where such appendix is adopted or approved.
- Mass walls shall be in accordance with Section R402.2.6. Where more than half the insulation is on the interior, the mass wall U-factors shall not exceed 0.17 in Climate Zones 0 and 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.
- In Warm Humid locations as defined by Figure R301.1 and Table R301.1, the basement wall U-factor shall not exceed 0.360.
- A maximum U-factor of 0.30 shall apply in Marine Climate Zone 4 and Climate Zones 5 through 8 to vertical fenestration products installed in buildings located either:
 - Above 4,000 feet in elevation above sea level, or
 - In windborne debris regions where protection of openings is required by Section R301.2.1.2 of the *International Residential Code*.
- F-factors for slabs shall correspond to the R-values of Table R402.1.3 and the installation conditions of Section R402.2.10.1.

- **Some requirements have been eased while others more stringent**
- **The table sets the baseline for envelope performance: each component meets its own specified U-factor**



R402.1.3 R-value Table

- Establishes minimum insulation R-values (some U and F) for each component
- Operates as the component-performance alternative
- Key changes: Ceiling insulation R-value went down

TABLE R402.1.3 INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT^a

CLIMATE ZONE	0	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7 AND 8
Vertical fenestration U-factor	0.50	0.50	0.40	0.30	0.30	0.28 ^g	0.28 ^g	0.27 ^g
Skylight U-factor	0.60	0.60	0.60	0.53	0.53	0.50	0.50	0.50
Glazed vertical fenestration SHGC	0.25	0.25	0.25	0.25	0.40	NR	NR	NR
Skylight SHGC	0.28	0.28	0.28	0.28	0.40	NR	NR	NR
Ceiling R-value	30	30	38	38	49	49	49	49
Insulation entirely above roof deck	25ci	25ci	25ci	25ci	30ci	30ci	30ci	35ci
Wood-framed wall R-value ^e	13 or 0&10ci	13 or 0&10ci	13 or 0&10ci	20 or 13&5ci or 0&15ci	30 or 20&5ci or 13&10ci or 0&20ci	30 or 20&5ci or 13&10ci or 0&20ci	30 or 20&5ci or 13&10ci or 0&20ci	30 or 20&5ci or 13&10ci or 0&20ci
Mass wall R-value ^f	3/4	3/4	4/6	8/13	8/13	13/17	15/20	19/21
Floor R-value ^h	13 or 7+5ci or 10ci	13 or 7+5ci or 10ci	13 or 7+5ci or 10ci	19 or 13+5ci or 15ci	19 or 13+5ci or 15ci	30 or 19+7.5ci or 20ci	30 or 19+7.5ci or 20ci	38 or 19+10ci or 25ci
Basement wall R-value ^{h, e}	0	0	0	5ci or 13 ^d	10ci or 13	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci
Unheated slab R-value & depth ⁱ	0	0	0	10ci, 2 ft	10ci, 3 ft	10ci, 3 ft	10ci, 4 ft	10ci, 4 ft
Heated slab R-value & depth ⁱ	R-5ci edge and R-5 full slab	R-5ci edge and R-5 full slab	R-5ci edge and R-5 full slab	R-10ci, 2 ft and R-5 full slab	R-10ci, 3 ft and R-5 full slab	R-10ci, 3 ft and R-5 full slab	R-10ci, 4 ft and R-5 full slab	R-10ci, 4 ft and R-5 full slab
Crawl space wall R-value ^{h, e}	0	0	0	5ci or 13 ^d	10ci or 13	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci

For SI: 1 foot = 304.8 mm.

NR = Not Required, ci = Continuous Insulation.

- R-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed R-value of the insulation shall be not less than the R-value specified in the table.
- "5ci or 13" means R-5 continuous insulation (ci) on the interior or exterior surface of the wall or R-13 cavity insulation on the interior side of the wall. "10ci or 13" means R-10 continuous insulation (ci) on the interior or exterior surface of the wall or R-13 cavity insulation on the interior side of the wall. "15ci or 19 or 13&5ci" means R-15 continuous insulation (ci) on the interior or exterior surface of the wall; or R-19 cavity insulation on the interior side of the wall; or R-13 cavity insulation on the interior of the wall in addition to R-5 continuous insulation on the interior or exterior surface of the wall.
- Slab insulation shall be installed in accordance with Section R402.2.10.1.
- Basement wall insulation is not required in Warm Humid locations as defined by Figure R301.1 and Table R301.1.
- The first value is cavity insulation; the second value is continuous insulation. Therefore, as an example, "13&5" means R-13 cavity insulation plus R-5 continuous insulation.
- Mass walls shall be in accordance with Section R402.2.6. The second R-value applies where more than half of the insulation is on the interior of the mass wall.
- A maximum U-factor of 0.30 shall apply in Marine Climate Zone 4 and Climate Zones 5 through 8 to vertical fenestration products installed in buildings located either:
 - Above 4,000 feet in elevation.
 - In windborne debris regions where protection of openings is required by Section R301.2.1.2 of the International Residential Code.



R402.1.5 – Component Performance Alternative

- **Offers an alternate compliance path under the residential prescriptive path**
- **Rather than meeting each assembly, the builder may demonstrate overall envelope performance equivalency**
- **Requires calculation of proposed overall UA compared to a reference UA; must be equal to or better than**
- **Encourages higher-performance components in some areas and less stringent values in others**

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My Projects Scenario Modeling

Projects 6 Design Changes > Scenarios > Results > Review and Submit

New Scenario

Infiltration Change ✕

Slab Change ✕

Wall Change ✕

Rim Joist Change ✕

Ceiling / Roof Change ✕

Floor Change ✕

Window / Glass Door Change +

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Infiltration Change ✕

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Floor Change ✕

Window / Glass Door Change +

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+ Add Scenario v

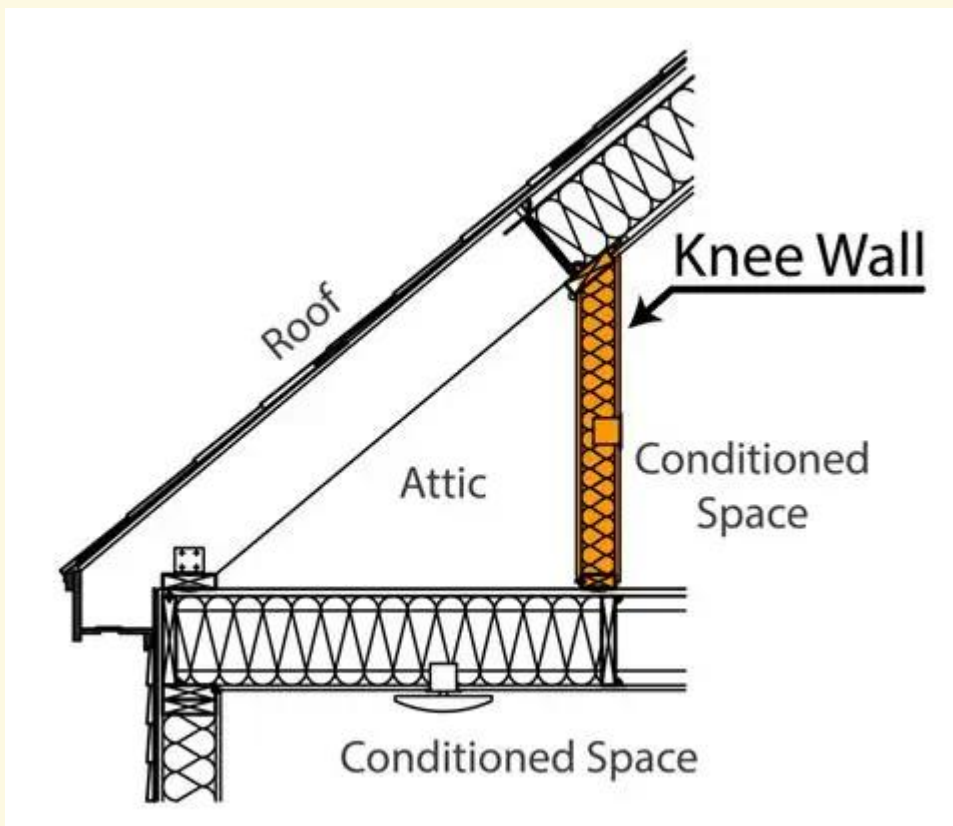
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Results -->

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R402.2.3 – Attic Knee Walls



- **Applies specifically to attic knee-wall assemblies where conditioned living space separates unconditioned attic space**
- **Must include an air barrier on the unconditioned attic side**
- **Requires knee-wall assemblies must comply with requirements in Table R402.1.3 for wood-framed walls**
- **Highlights importance of proper insulation and air-sealing – often weak points**
- **Ensures that this rarely-considered space is included in compliance**



R402.2.3.1 – Truss framing separating conditioned and unconditioned space

- **Applies when wood vertical roof truss framing separates conditioned from unconditioned**
- **Assemblies must comply with the insulation requirements of Table R402.1.3 of wood-frame walls**
- **Steel truss walls follow R402.2.7**
- **Ensures these often-overlooked areas meet the same envelope performance as above-grade walls**





R402.2.13 – Sunroom and heated garage insulation

- **Applies to conditioned sunrooms and heated garages**
- **Must meet the insulation requirements:**
 - **Ceiling insulation R19**
 - **Wall insulation R13**
- **Ensures the boundary and the rest of the home is properly insulated**
- **Design-team and builders must include these spaces in the envelope compliance reports**





Table R402.5.1.1 – Checklist

- **Specific installation inspection criteria for key components of the building envelope**
- **Applies primarily to prescriptive path**
- **Includes mandatory checklists**
- **Helps ensure that what's specified is actually constructed rather than just documented**

TABLE R402.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION^a

COMPONENT	AIR BARRIER, AIR SEALING CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building thermal envelope. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	An air barrier shall be installed in any dropped ceiling or soffit to separate it from unconditioned space. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed with gasketing materials that allow for repeated entrance over time.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier. Access hatches and doors shall be installed and insulated in accordance with Section R402.2.5. Eave baffles shall be installed in accordance with Section R402.2.4.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Exterior building thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Knee wall	Knee walls shall have an air barrier between conditioned and unconditioned space	Insulation installed in a knee wall assembly shall be installed in accordance with Section R402.2.3. Air-permeable insulation shall be enclosed inside an air barrier assembly.
Windows, skylights and doors	The rough opening gap between framing and the frames of skylights, windows and doors, shall be sealed in accordance with fenestration manufacturer's instructions.	Insulation shall not be required in the rough opening gap except as required by the fenestration manufacturer's instructions.
Rim joists	Rim joists shall include an air barrier. The junctions of the rim board to the sill plate and the rim board and the subfloor shall be air sealed.	Rim joists shall be insulated so that the insulation maintains permanent contact with the exterior rim board. ^b
Floors, including cantilevered floors and floors above garages	Floor framing members that are part of the building thermal envelope shall be air sealed to maintain a continuous air barrier. Air permeable floor cavity insulation shall be enclosed.	Floor insulation shall be installed in accordance with the requirements of Section R402.2.8.
Basement, crawl space and slab foundations	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder/air barrier in accordance with Section R402.2.11. Penetrations through concrete foundation walls and slabs shall be air sealed. Class 1 vapor retarders shall not be used as an air barrier between grade walls and shall be installed in accordance with Section R402.2.11.	Crawl space insulation, where provided instead of floor insulation, shall be installed in accordance with Section R402.2.11. Conditioned basement foundation wall insulation shall be installed in accordance with Section R402.2.9.1. Slab-on-grade floor insulation shall be installed in accordance with



R402.5.1.1 – Common and Double Walls

- **Air barrier, air sealing and insulation installation requirements were added for common walls and double walls**

Common walls or double walls separating attached single-family dwellings or townhouses

An interior air barrier shall be provided. Air sealing at the intersections with building thermal envelope shall be provided.

Where installed in a fire-resistance-rated wall assembly, air sealing materials shall comply with one of the following:

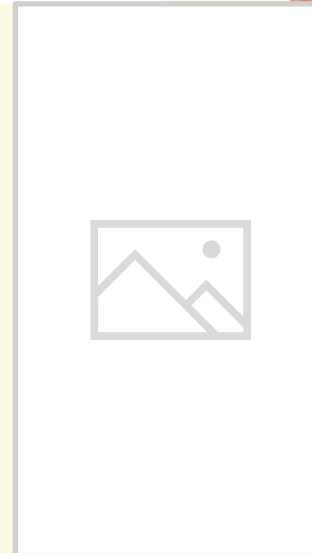
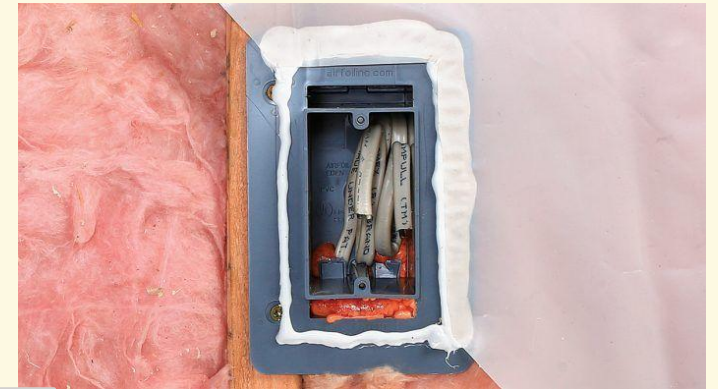
1. Be in accordance with an approved design for the fire-resistance-rated assembly.
2. Be supported by approved data that shows the assembly as installed complies with the required fire-resistance rating.

Insulation materials recognized in the approved common wall or double-wall design and installed in accordance with the approved design shall be permitted to be used.



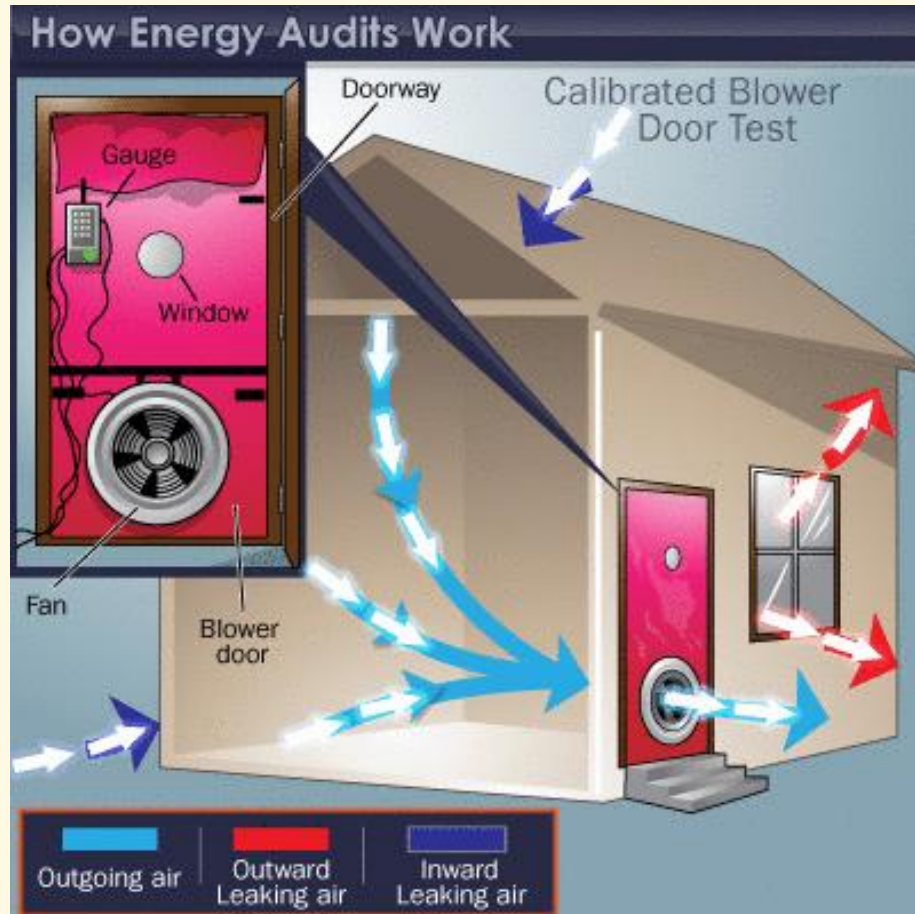
R402.5.1.1 – Air-sealed Electrical and Communication Outlet Boxes

- **Outlet boxes (electrical/communication) installed in the thermal envelope must be sealed**
- **Purpose: Prevent unintended air leakage**
- **Ensure the air barrier design and execution include or account for all outlet boxes and that specified boxes are used, or the air barrier is continuous behind the boxes**





R402.5.1.3 – Testing



- **Prescriptive:**
 - **Climate Zone 1 and 2 – 4.0 ACH**
 - **Climate Zone 3 and 4 – 3.0 ACH**
- **Performance and ERI**
 - **All CZ – 4.0 or 0.22 cubic feet per minute per sq ft of the enclosure area**
- **Exceptions:**
 - **Where dwelling or sleeping units are attached or located in R-2 Occupancy – 0.27 (no guarded testing)**
 - **Building 1500 sq ft or less – 0.27**



Sampling Protocol

Applies to:

Multiple identical buildings

Large multifamily developments

Less than 8 – Test All

More than 8 – Test greater of 7 or 20%

Must include top, middle, ground floor, and units w/ the largest enclosure area

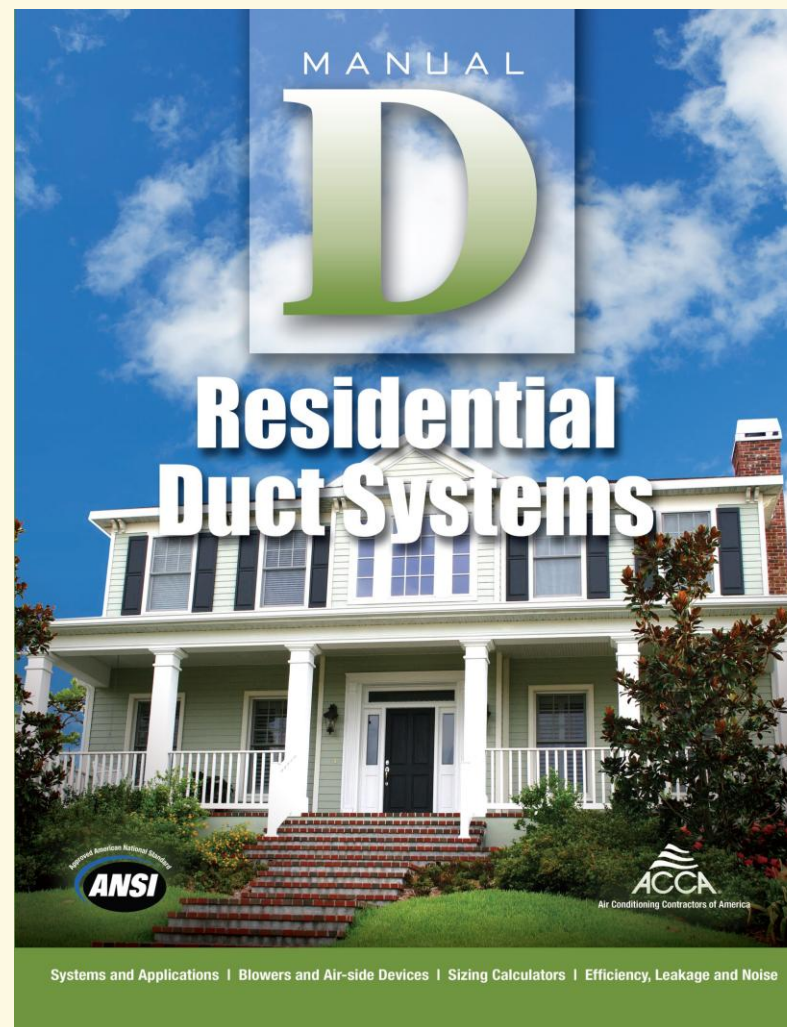
When a unit fails, it must be corrected and 3 more units added

Excludes: corridors, stairwells, and enclosed spaces not greater than 1500 ft²



R403.3.1 – Duct System Design

- **Duct systems must be designed and sized according to ANSI/ACCA Manual D**
- **Ensures that the duct system is not treated as an after-thought but is integrated and designed to minimize losses and maintain performance**





R403.3.3 – Ducts Outside Conditioned Space

- **Supply and Return ductwork located outside of the conditioned space shall be insulated to an **R8** for ducts 3 inches or larger and R6 for less than 3 inches**
- **Duct insulation is no longer based on any other locations other than outside or inside the conditioned space**





R403.3.4 – Ducts Inside Conditioned space

For Ducts located within the conditioned space – Such as foam encapsulation

Ductwork contained within wall or floor assemblies separating unconditioned from conditioned space shall comply with the following:

3.1 A continuous air barrier shall be installed as part of the building assembly between the duct and the unconditioned space

3.2 Ductwork shall be installed in accordance with Section R403.3.3

3.3 Not less than R-10 insulation, and not less than 50% of the required insulation R-value specified in Table R402.1.3, whichever is greater, shall be located between the duct and the unconditioned space

3.4 Floor ducts in the building assemblies to be considered within conditioned space, the air handler shall be installed within conditioned space





R403.3.7, R403.3.8 – Duct System Testing

- **Each duct system shall be tested for air leakage**
- **Total measured duct system leakage is based on the conditioned floor area, number of ducted returns, and location of the duct system**
- **For buildings using performance or ERI, leakage to the outside shall not be used for compliance with this section, but shall be permitted to be used in the calculation procedures**

TABLE R403.3.8 MAXIMUM TOTAL DUCT SYSTEM LEAKAGE

EQUIPMENT AND DUCT CONFIGURATION	DUCT SYSTEMS SERVING MORE THAN 1,000 FT ² OF CONDITIONED FLOOR AREA		DUCT SYSTEMS SERVING 1,000 FT ² OR LESS OF CONDITIONED FLOOR AREA
	cfm/100 ft ²		cfm
	Number of ducted returns ^a		
	< 3	≥ 3	Any
Space conditioning equipment is not installed ^{b, c}	3	4	30
All components of the duct system are installed ^c	4	6	40
Space conditioning equipment is not installed, but the ductwork is located entirely in conditioned space ^{c, d}	6	8	60
All components of the duct system are installed and entirely located in conditioned space ^c	8	12	80



R403.6 – Mechanical Ventilation System

- **Each building and dwelling unit shall be provided with mechanical ventilation that complies with Section M1505 of the IMC**
- **Outdoor intakes and exhausts shall have automatic or gravity dampers that close with not operating**





R403.6.2 – Fan Efficacy for Mechanical Ventilation Systems

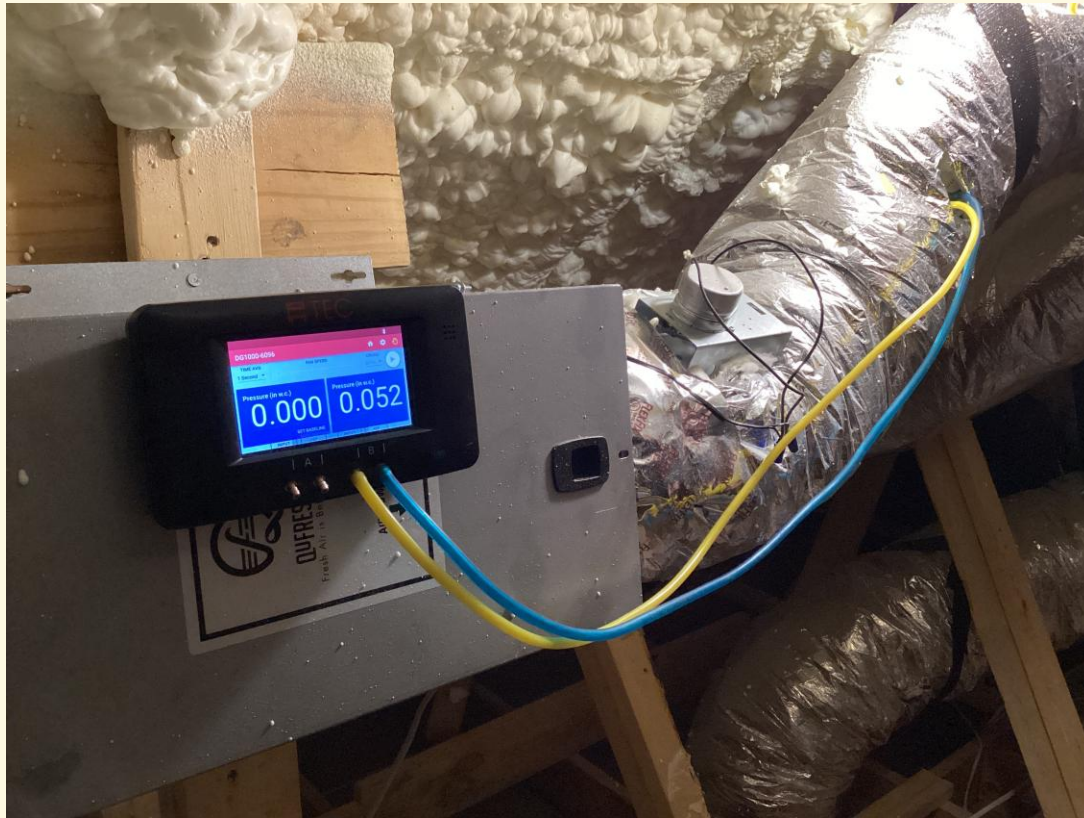
TABLE R403.6.2 FAN EFFICACY FOR WHOLE-HOUSE MECHANICAL VENTILATION SYSTEMS AND OUTDOOR AIR VENTILATION SYSTEMS^a

SYSTEM TYPE	AIRFLOW RATE (CFM)	MINIMUM EFFICACY (CFM/WATT)	TEST PROCEDURE
HRV or ERV	Any	1.2 ^a	CAN/CSA C439
Balanced ventilation system without heat or energy recovery	Any	1.2 ^a	ANSI/AMCA 210-ANSI/ASHRAE 51
Range hood	Any	2.8	
In-line supply or exhaust fan	Any	3.8	ANSI/AMCA 210-ANSI/ASHRAE 51
Other exhaust fan	< 90	2.8	
	≥ 90 and < 200	3.5	
	≥ 200	4.0	
Air-handling unit that is integrated to tested and listed HVAC equipment	Any	1.2	Outdoor airflow as specified. Air-handling unit fan power determined in accordance with the applicable US Department of Energy Code of Federal Regulations DOE10 CFR 430 or other approved test method.

- **Fans used for mechanical ventilation shall meet the efficacy requirements of Table R403.6.2**
- **ERV's and In-line fans shall be tested at a pressure of 0.2 iwc**



R403.6.2 – Mechanical Ventilation System Testing



- **Mechanical ventilation shall be tested and verified to provide minimum ventilation required by R403.6**
- **Testing shall be conducted by an approved 3rd party**
- **Written report shall be signed by party conducting the testing**



R403.6.5 – Intermittent Exhaust Control for Bathrooms and Toilet Rooms

- **Applies to an exhaust system designed for intermittent operation**
- **Exhaust fan must have controls such as time-switch, occupant sensor, humidity sensor, or contaminant sensor**
- **Ensures they shut off or reduce operation when not in use**





R403.13 – Gas Fireplaces



- **Gas fireplaces shall not be equipped with continuous pilot light**
- **Must be instead an on-demand pilot, intermittent ignition, or interrupted ignition system**
- **For vented gas fireplace heaters, a minimum Fireplace Efficiency (FE) rating of 50% or higher is required**



R404.1 – Lighting Equipment

- **All permanently installed luminaires shall be capable of operation with an efficacy of not less than 45 lumens per watt or shall contain lamps capable of operation at 65 lumens per watt or greater**
- **Exceptions**
 1. **Kitchen appliance lighting**
 2. **Antimicrobial lighting used for the sole purpose of disinfecting**
 3. **General service lamps complying with DOE 10 CFR**
 4. **Luminaries with a rated input of not greater than 3.0 watts**





Table R404.1 – Lighting Power Allowances for Building Exterior

TABLE R404.1 LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS

BASE SITE ALLOWANCE	280 WATTS
Uncovered parking areas and drives	0.026 W/ft ²
Building grounds	
Walkways and ramps	0.50 W/linear foot
Plaza areas	0.049 W/ft ²
Dining areas	0.273 W/ft ²
Stairways	Exempt
Pedestrian tunnels	0.110 W/ft ²
Landscaping	0.025 W/ft ²
Building entrances and exits	
Pedestrian and vehicular entrances and exits	9.8 W/linear foot of opening
Entry canopies	0.126 W/ft ²

For SI: 1 watt per square foot = 10.76 w/m², 1 foot = 304.8 mm.

- Establishes max exterior lighting power based on area type
- Helps ensure outdoor lighting is energy-efficient
- Sets base site at 280W



R404.1.1 – Exterior Lighting

- **Applies to connected exterior lighting systems in residential buildings**
- **Shall comply with Sections R404.1.2 – R404.1.5**
- **Exceptions:**
 - **Detached single-family**
 - **Townhouses**
 - **Group R-3 no more than 2 units**
 - **Solar-powered lamps**
 - **Lights w/ motion sensor**
 - **Lights that comply with R404.1**





R404.1.2, 3, and 4 – Exterior Lighting



- **R404.1.2 – Exterior lighting power requirements**
- **R404.1.3 – Exterior lighting power allowance**
- **R404.1.4 – Additional exterior lighting power**
- **R404.1.5 – Gas Lighting**



R404.2 – Interior Lighting Controls

- **All permanently installed luminaires shall be controlled as required in Section R404.2.1 and R404.2.2**
 - **R404.2.1 Habitable spaces** – all permanently installed luminaires in habitable spaces shall be controlled with a dimmer or an automatic shut-off control that automatically turns off lights within 20 minutes and incorporate a manual control to allow occupants to turn the lights on or off
 - **R404.2.2 Specific locations** – All permanently installed luminaires in garages, unfinished basements, laundry rooms, and utility rooms shall be controlled by an automatic shut-off control that automatically turns off lights within 20 minutes and incorporate a manual control to allow occupants to turn the lights on or off





R404.3 – Exterior Lighting Controls

- **Exterior lighting controlled from within individual dwelling units shall comply with Section R404.3.1. Controls for all other exterior lighting shall comply with Sections C405.2.7 of the IECC instead of R404.3.1**
- **R404.3.1 Controls for individual dwelling units – Where the total permanently installed exterior lighting power is greater than 30 watts. The permanently installed exterior lighting shall comply with the following:**
 - **Lighting shall be controlled by a manual on and off switch which permits automatic shut-off actions**
 - **Lighting shall be automatically shut off when daylight is present and satisfies the lighting needs**
 - **Controls that override automatic shut-off actions shall not be allowed unless the override automatically returns automatic control to its normal operation within 24 hours**





R405 – Simulated Building Performance



- The sum of the proposed TC will be less than or equal to the TC using prescriptive U- and F-factors:
 - For CZ 0-2: TC Proposed design $\leq 1.08 \times$ TC Prescriptive reference design
 - For CZ 3-8: TC Proposed design $\leq 1.15 \times$ TC Prescriptive reference design
 - Area-weighted average max SHGC 0.30 in CZ 0-3



R405 – Simulated Building Performance



For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design.

For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the standard reference design.

For dwelling units with greater than 5,000 square feet (465 m²) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design.



R405 – Performance Mandatory Items

- **Applies to homes using the Simulated Performance Path**
- **All mandatory provisions from Chapter 4 and 5 must be met**
- **Includes air leakage testing, duct testing, insulation, and controls**
- **Ensures modeled performance homes maintain minimum code standards**

TABLE R405.2 REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

SECTION ^a	TITLE
General	
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.1.6	Rooms containing fuel-burning appliances
R402.2.3	Attic knee wall
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and door insulation installation and retention
R402.2.10	Slab-on-grade floors
R402.2.11	Crawl space walls
R402.5.1.1	Installation
R402.5.1.2	Air leakage testing
R402.5.1.3	Maximum air leakage rate
R402.5.2	Fireplaces
R402.5.3	Fenestration air leakage
R402.5.4	Recessed lighting
R402.5.5	Air-sealed electrical and communication outlet boxes
R402.6	Maximum fenestration U-factor and SHGC
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Duct systems
R403.4	Mechanical system piping insulation
R403.5	Service hot water systems
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9.2	Snow melt and ice system controls
R403.10	Energy consumption of pools and spas
R403.11	Portable spas
R403.12	Residential pools and permanent residential spas
R403.13	Gas fireplaces
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls



R406.1 – ERI Path



REM/*Rate*TM



- **Provides a performance-based compliance using a 0-100 Energy Rating Index (ERI) score**
- **Lower ERI = more efficient home (100 = 2006 IECC baseline, 0 = net-zero energy)**
- **Requires compliance with all mandatory prescriptive items plus max score for each CZ**
- **Two separate index allowance based on renewable not used or with renewable used**



R406 – ERI Mandatory Items

- **ERI compliance requires all mandatory measures from Chapter 4 and 5**
- **Includes air leakage testing, insulation installation, and duct testing**
- **Applies to mechanical systems, lighting, and service hot water**
- **Ensure homes using the ERI meet baseline energy efficiency standards**

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

SECTION ^a	TITLE
General	
R401.3	Certificate
Building thermal envelope	
R402.1.1	Vapor retarder
R402.1.6	Rooms containing fuel-burning appliances
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and door insulation installation and retention
R402.2.10	Slab-on-grade floors
R402.2.11	Crawl space walls
R402.5.1.1	Installation
R402.5.1.2	Air leakage testing
R402.5.1.3	Maximum air leakage rate
R402.5.2	Fireplaces
R402.5.3	Fenestration air leakage
R402.5.4	Recessed lighting
R402.5.5	Air-sealed electrical and communication outlet boxes
R406.3	Building thermal envelope
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Duct systems
R403.4	Mechanical system piping insulation
R403.5	Service hot water systems
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9.2	Snow melt and ice system controls
R403.10	Energy consumption of pools and spas
R403.11	Portable spas
R403.12	Residential pools and permanent residential spas
R403.13	Gas fireplaces
Electrical power and lighting systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls



R406.3 – Building Thermal Envelope

- **Requires the thermal envelope to meet or exceed prescriptive code values**
- **Focuses on insulation levels, window performance, and air sealing**
- **Ensures consistent efficiency baseline before adding renewables or credits**
- **Modeled homes must still comply with envelope backstop limits in Table R406.3**

Building Thermal Envelope

- **Components:**
 - Fenestration
 - Windows, doors, skylights
 - Ceilings
 - Walls
 - Above grade
 - Below grade
 - Mass walls
 - Floors
 - Slab
 - Crawl space

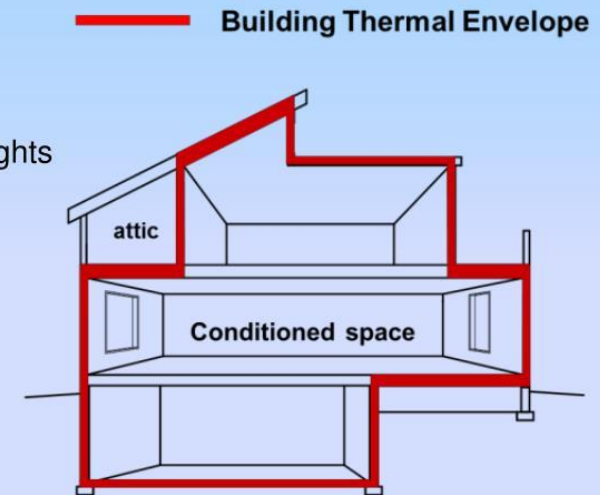




Table R406.5 Maximum ERI

- Establishes the max ERI
- ERI's vary by CZ
- Separate limits apply for with or without on-site power production (OPP)
- Ensures homes achieve consistent efficiency regardless of renewables

TABLE R406.5 MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX NOT INCLUDING OPP	ENERGY RATING INDEX WITH OPP
0 and 1	51	35
2	51	34
3	50	33
4	53	40
5	54	43
6	53	43
7	52	46
8	52	46

Texas HB 3215 Adjusted ERI/HERS Score

Timeline	Climate Zone 2 HERS Index	Climate Zone 3 HERS Index	Climate Zone 4 HERS Index
09/01/2019 – 08/31/2022	63	63	67
09/01/2022 – 08/31/2025	59	59	63
09/01/2025 – 08/31/2028	57	57	61
09/01/2028 – 09/01/2031	55	55	59

Source: [20220712_611759_RESNETHB3215DemoSessionSunbeltJuly13chcd-1.pdf](#)



R408 – Additional Efficiency Requirements

- Introduces a credit-based system for energy efficiency upgrades
- Builders must earn a set number of credits based on climate zone
- Credits can be achieved through envelope improvements, HVAC upgrades, or renewables
- Provides flexible in meeting higher efficiency targets while encouraging innovation

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

MEASURE NUMBER	MEASURE DESCRIPTION	CREDIT VALUE								
		Climate Zones 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4 Except Marine	Climate Zone 4 Marine	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥ 2.5% Reduction in total TC	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥ 5% reduction in total TC	0	1	1	2	1	2	2	2	2
R408.2.1.1(3)	> 7.5% reduction in total TC	0	1	2	2	2	2	3	3	3
R408.2.1.1(4)	> 10% reduction in total TC	1	1	2	3	3	4	4	5	5
R408.2.1.1(5)	> 15% reduction in total TC	1	2	2	4	4	5	6	7	8
R408.2.1.1(6)	> 20% reduction in total TC	2	4	4	5	6	7	8	9	11
R408.2.1.1(7)	> 30% reduction in total TC	3	6	6	8	8	11	12	13	16
R408.2.1.2(1)	U-factor and SHGC for vertical fenestration per Table R408.2.1.2	1	1	1	2	1	1	1	1	1
R408.2.1.3(1)	Roof solar reflectance index (roof is part of the building thermal envelope and directly above cooled, conditioned space)	1	0	0	0	0	0	0	0	0
R408.2.1.3(2)	Roof solar reflectance index (roof is above an unconditioned space that contains a duct system)	1	1	0	0	0	0	0	0	0
R408.2.1.4	Reduced air leakage	1	1	1	2	1	3	NA	NA	NA
R408.2.2(1) ^b	Ground source heat pump	14	14	14	15	10	15	17	18	21
R408.2.2(2) ^b	High Performance Cooling (Option 1)	5	4	3	2	1	1	1	1	1
R408.2.2(3) ^b	High Performance Cooling (Option 2)	6	4	3	2	1	1	1	1	1
R408.2.2(4) ^b	High Performance Gas furnace (Option 1)	0	1	2	5	3	6	7	7	9
R408.2.2(5) ^b	High Performance Gas furnace (Option 2)	0	1	2	4	3	5	6	7	8
R408.2.2(6) ^b	High Performance Gas furnace (Option 3)	0	1	1	NA	NA	NA	NA	NA	NA
R408.2.2(7) ^b	High Performance Gas furnace and cooling (Option 1)	5	5	4	NA	NA	NA	NA	NA	NA



R408 – Additional Efficiency Requirements

- **Must select additional efficiency package(s)**
- **Minimum of 10 credits required (Table R408.2)**
- **Must pick a minimum of 2 separate packages**
- **Homes larger than 5,000 sq. ft. require an additional 5 credits**
- **Measures must meet specific R408 requirements by CZ**
- **Credits vary based on selected efficiency improvements**

R408.2 Additional Energy Efficiency Credit Requirements – Two of the additional measures shall be selected from Table R408.2 that meet or exceed a total of ten credits

Five additional credits shall be selected for dwelling units with greater than 5,000 sq.ft. of living space floor area located above grade plane

Each measure selected shall meet the relevant subsections of Section R408 and receive credit as specified in Table R408.2 for the specific CZ



COM*check* - Web

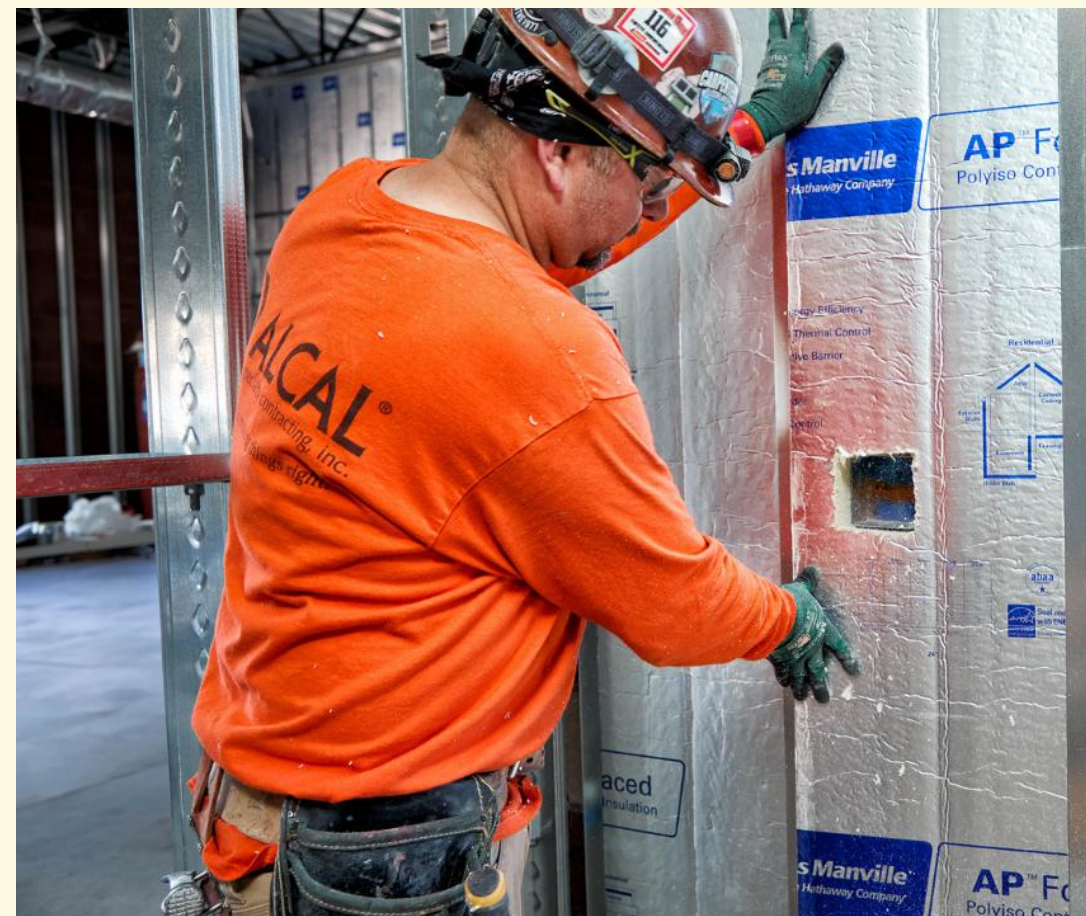


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Why Enforcement Matters!

- **30 – 40% energy loss through envelope issues**
- **Most IECC violations are documentation errors**
- **Envelope mistakes most 10x more to fix after construction**
- **Air leakage failures can delay C of O**





You need Software!!

- **Prescriptive – C402 thru C406 and Section C408**
 - **Assembly *U*-factor, *C*-factor or *F*-factor method**
 - **Insulation component *R*-value method**
- **Performance – Section C407**
 - **Component performance method**
- **ASHRAE 90.1** (ANSI/ASHRAE/IEC 90.1)
 - **COMcheck, OpenStudio and EnergyPlus**





COMcheck – Web – Project



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PROJECT

ENVELOPE

INTERIOR LIGHTING

EXTERIOR LIGHTING

MECHANICAL

REQUIREMENTS

COMPLIANCE

<

 COLLAPSE

Once Project Information is complete - click 'ENVELOPE' button to go to Envelope page.

Project Title

TEST Project

Location (Climate Zone 3) ?

Fort Worth, Texas

Energy Code ?

2015 IECC

Project Type ?

New Construction

Efficiency Compliance Option ?

Reduced Lighting Power

Air Barrier Compliance Option ?

Air Barrier Permeability

Features

All Electric Property: ☒ Yes ☐ No

Renewable Energy Installed: ☐ Yes ☒ No

Battery Storage Installed: ☐ Yes ☒ No

EV Charger Installed: ☐ Yes ☒ No

Heat Pump Installed: ☒ Yes ☐ No

>

 Building Areas ?

Nail Salon /Retail

Residential

Area: 1100

ADD BUILDING AREA



COMcheck – Web – Envelope

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REQUIREMENTS

COMPLIANCE

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2015 IECC • Fort Worth, Texas • Climate Zone 3 • New Construction

3% 49% TBD

ENVELOPE

FENESTRATION REQUIREMENTS

DAYLIGHTING ALLOWANCE

CHECK COMPLIANCE

SAVE

Search
Search by name/description or filter result

▼ Retail : Nail Salon

AREA ACTIONS

ROOF [1] EXTERIOR WALL [4] FLOOR [1] BASEMENT

Assemblies

ASSIGN

ITEM ACTIONS

ADD ASSEMBLIES

	Assembly	Gross Area	Orientation	Cavity R-Value	Continuous R-Value	U-Factor	SHGC	VT	Projection Factor	Details
1	☐ Ext Wall WOOD FRAME, 16" O.C.	2326	UNSPECIFIED	19	0	0.067	--	--	--	...
2	☐ Window METAL FRAME WITH THERMAL BREAK	80		0	0	0.46	0.4	0.3	0.5	...
3	☐ Door INSULATED METAL	17		0	0	0.035	0	0	0	...
4	☐ Door 1 GLASS (OVER 50% GLAZING)	24		0	0	0.77	0.4	0.3	0.5	...

PLAN REVIEW INSULATION FENESTRATION AIR LEAKAGE

☒ [C103.2] Plans and/or specifications provide all information with which compliance can be determined for the building envelope and document where exceptions to the standard are claimed.



COMcheck – Web – Envelope

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PROJECT

ENVELOPE

INTERIOR LIGHTING

EXTERIOR LIGHTING

MECHANICAL

REQUIREMENTS

COMPLIANCE

COLLAPSE

2015 IECC • Fort Worth, Texas • Climate Zone 3 • New Construction

3% 49% TBD

ENVELOPE

FENESTRATION REQUIREMENTS

DAYLIGHTING ALLOWANCE

CHECK COMPLIANCE

SAVE

Search
Search by name/description or filter result

Retail : Nail Salon

AREA ACTIONS

ROOF [1] EXTERIOR WALL [4] FLOOR [1] BASEMENT

Assemblies

ASSIGN ITEM ACTIONS ADD ASSEMBLIES

	Assembly	Gross Area/ Slab Perimeter	Cavity R-Value	Continuous R-Value	U-Factor	Insulation Position	Depth of Insulation	Details
1	☐ Floor UNHEATED SLAB-ON-GRADE	200	0	0	0.73	None	0	...

PLAN REVIEW INSULATION FENESTRATION AIR LEAKAGE

☒ [C103.2] Plans and/or specifications provide all information with which compliance can be determined for the building envelope and document where exceptions to the standard are claimed.



COMcheck – Web – Int. Lighting



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[MECHANICAL](#)

[REQUIREMENTS](#)

[COMPLIANCE](#)

[COLLAPSE](#)

2015 IECC • Fort Worth, Texas • Climate Zone 3 • New Construction

3%

49%

TBD

INTERIOR LIGHTING

[FIXTURE SCHEDULE](#)

[CHECK COMPLIANCE](#)

[SAVE](#)

Totals - Building Area Method: Allowed Wattage: 1386 Proposed Wattage: 810

Totals - Space by Space Method: Allowed Wattage: 1573 Proposed Wattage: 810



Nail Salon

[AREA ACTIONS](#)

Building Area Type: Retail

Space by Space Method: Allowed Wattage: 1573 Proposed Wattage: 810

Area: 1100 W/ft²: 1.26

[SPACES/FIXTURES](#)

[CONTROLS](#)

Lighting Spaces

[ITEM ACTIONS](#)

[ADD SPACES](#)

	Space Name	Area	Lighting Power Density (LPD)	Space Proposed Wattage	Space Target Wattage	Number of Fixtures	Fixture Wattage	Exemption/ Allowance
1	Space Sales Area	1100	1.59	810	1573			
1	Ceilnig LED					18	45	None

[PLAN REVIEW](#)

[POST CONSTRUCTION](#)

[CONTROLS](#)

[WATTAGE](#)



[C103.2] Plans, specifications, and/or calculations provide all information with which compliance can be determined for the interior lighting and electrical systems and equipment and document where exceptions to the standard are claimed. Information provided should include interior lighting power calculations, wattage of bulbs and ballasts, transformers and control devices.



COMcheck – Web – Ext. Lighting

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INTERIOR LIGHTING

💡

EXTERIOR LIGHTING

⚙️

MECHANICAL

📋

REQUIREMENTS

📊

COMPLIANCE

⏏

COLLAPSE

EXT

Zone:

FIX

49%

TBD

FIXTURE SCHEDULE

CHECK COMPLIANCE ✓

SAVE

ITEM ACTIONS

ADD BUILDING EXTERIORS

Unspecified

Residentially zoned area (LZ2)

Residential mixed use area (LZ2)

Neighborhood business district (LZ2)

High activity metropolitan commercial district (LZ4)

Light industrial area with limited nighttime use (LZ2)

Developed area in national or state park (LZ1)

Developed area on forest land (LZ1)

Developed rural area (LZ1)

Other (LZ3)



COMcheck – Web – Mechanical

?

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ENVELOPE

INTERIOR LIGHTING

EXTERIOR LIGHTING

MECHANICAL

REQUIREMENTS

COMPLIANCE

<

COLLAPSE

2015 IECC • Fort Worth, Texas • Climate Zone 3 • New Construction

3%

49%

TBD

Mechanical

CHECK
COMPLIANCE

SAVE

HVAC SYSTEM

FAN SYSTEM ?

PLANT ?

WATER HEATING ?

ITEM ACTIONS

ADD HVAC

	Component	System Type	Quantity	Capacity (kBtu/hr)	Fuel Type	Condenser Type	Fan System	System Details	Proposed Full Load Eff.	Required Full Load Eff.	Proposed Part Load Eff.	Required Part Load Eff.
1	Main Unit	HVAC	1				None	Single Zone				
1	Heating Mode	Heat Pump		60000 kBtu/h	Electric				8.5 COP	3.2 COP	–	–
1	Cooling Mode	Heat Pump Equipment		60000 kBtu/h				None	9.3 EER	9.3 EER	9.4 IEER	9.4 IEER

SYSTEM_SPECIFIC

PLAN REVIEW

POST CONSTRUCTION

HVAC

TESTING

Main Unit

[C403.2.3] Equipment minimum efficiency: Heat Pump: 3.20 COP 9.30 EER + 9.4 IEER



COMcheck – Web – Compliance



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ENVELOPE

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INTERIOR LIGHTING

💡

EXTERIOR LIGHTING

⚙️

MECHANICAL

📋

REQUIREMENTS

📊

COMPLIANCE

⏏

COLLAPSE

2015 IECC • Fort Worth, Texas • Climate Zone 3 • New Construction

🏢 3%

💡 49%

🏠 TBD

COMPLIANCE

REPORTS

CHECK COMPLIANCE

SAVE

- COMPLIANCE RESULTS

🏢

Building Envelope compliance check

No status message.

3%

💡

Interior Lighting compliance check

Interior Lighting Passes: Design 49% better than Code

49%

		Wattage		
	Method	Allowed	Proposed	Score
Project Totals:	Building Area	1386.00	810.00	
	Space-by-Space	1573.00	810.00	49%

🏠

Exterior Lighting compliance check

Valid exterior lighting area(s) must be provided on the project screen.

TBD

	Wattage		
	Allowed	Proposed	Score
Project Totals:	0.00	tbd	

- PROJECT AUDIT



SPEER
The Sustainable Partnership for Energy Efficiency as a Resource



COMcheck – Web – Report



Compliance Certificate

Project Information

Energy Code: 2015 IECC
Project Title: TEST Project
Location: Fort Worth, Texas
Climate Zone: 3a
Project Type: New Construction
Project No: 7521
All Electric: true
Is Renewable: false
Has Battery: false
Has Charger: false
Has Heat Pump: true

Construction Site: Owner/Agent Designer/Contractor:

Notes:

Energy Credits

Description	Credit
Reduced Lighting Power	1.0

Credits: 1.0 Required 1.0 Proposed

Building Area

Description	Floor Area
1-Nail Salon (Retail) - Residential	1100



Envelope Compliance Certificate

Project Information

Energy Code: 2015 IECC
Project Title: TEST Project
Location: Fort Worth, Texas
Climate Zone: 3a
Project Type: New Construction
Vertical Glazing / Wall Area: 0.045

Construction Site: Owner/Agent Designer/Contractor:

Envelope Assemblies

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor
Roof/Roof, Insulation Entirely Above Deck, 5-Year-Aged Solar Reflectance Index < 0.84 (a), (Bldg. Use 1 - Nail Salon)	1100	---	30.00	0.032	0.039
Floor/Floor, Unheated Slab-On-Grade, (Bldg. Use 1 - Nail Salon) (c)	200	---	---	0.730	0.730
Ext Wall/Ext Wall, Wood Frame, Any Spacing, (Bldg. Use 1 - Nail Salon)	2326	19.00	0.00	0.067	0.064
Window/Window, Metal Frame with Thermal Break, Perf. Specs.: Product ID, SHGC 0.40, PF 0.50, VT 0.30, (Bldg. Use 1 - Nail Salon) (b)	80	---	---	0.460	0.460
Door/Door, Insulated Metal, Sliding, (Bldg. Use 1 - Nail Salon)	17	---	---	0.035	0.010
Door/Door 1, Perf. Specs.: Product ID, SHGC 0.40, PF 0.50, VT 0.30, (Bldg. Use 1 - Nail Salon) (b)	24	---	---	0.770	0.770

(a) Budget U-factors are used for software baseline calculations. ONLY, and are not code requirements.
(b) Fenestration product performance must be certified in accordance with NFRC and requires supporting documentation.
(c) Slab-On-Grade proposed and budget U-factors shown in table are F-factors.
(d) High albedo roof requirement options: 1) 3-year aged solar reflectance ≥ 0.55 thermal emittance ≥ 0.75 , 2) 3-year aged solar reflectance index ≥ 84.0 , 3) Initial year aged solar reflectance ≥ 0.70 thermal emittance ≥ 0.75 , 4) Initial year aged solar reflectance index ≥ 82.0 .

Envelope PASSES: Design 3% better than code

Envelope Compliance Statement

Compliance Statement: The proposed envelope design represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed envelope systems have been designed to meet the 2015 IECC requirements in COMcheckWeb and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Name - Title Signature Date

- Projected vs. Final
- Projected = plan review and design phase
- Final = field verification and as-built conditions
- Both must align with code and documentation



C105.2 – Info needed on Construction Documents

- **Energy Compliance Path**
- **Insulation materials and R-values**
- **Fenestration U-factors and SHGC coefficients**
- **Area-weighted U-factor and SHGC calculations**
- **Air barrier and air sealing details, including location**
- **Thermal bridges**
- **Mechanical system design criteria**
- **Mechanical and service water-heating systems and types, sizes and efficiencies**
- **Economizer description**
- **Equipment and system controls**
- **Fan motor horsepower (hp) and controls**
- **Duct sealing, duct and pipe insulation and location**
- **Lighting fixture schedule w/ wattage and control narrative**
- **Location of daylight zones**
- **Location of pathways for raceways from on-site renewable system to electrical distribution**
- **Location reserved for inverters, metering equipment and energy storage systems (ESS)**
- **Location and layout of a designated area for ESS**
- **Rated energy capacity and rated power capacity of the installed or planned ESS**



Building Characteristics: Multifamily

- **Multifamily if:**
 - **All multifamily buildings are 3 stories or less in height above grade and**
 - **Contain three or more attached dwelling units**
- **Examples**
 - **Apartments**
 - **Condos**
 - **Townhouses**
 - **Dormitories**

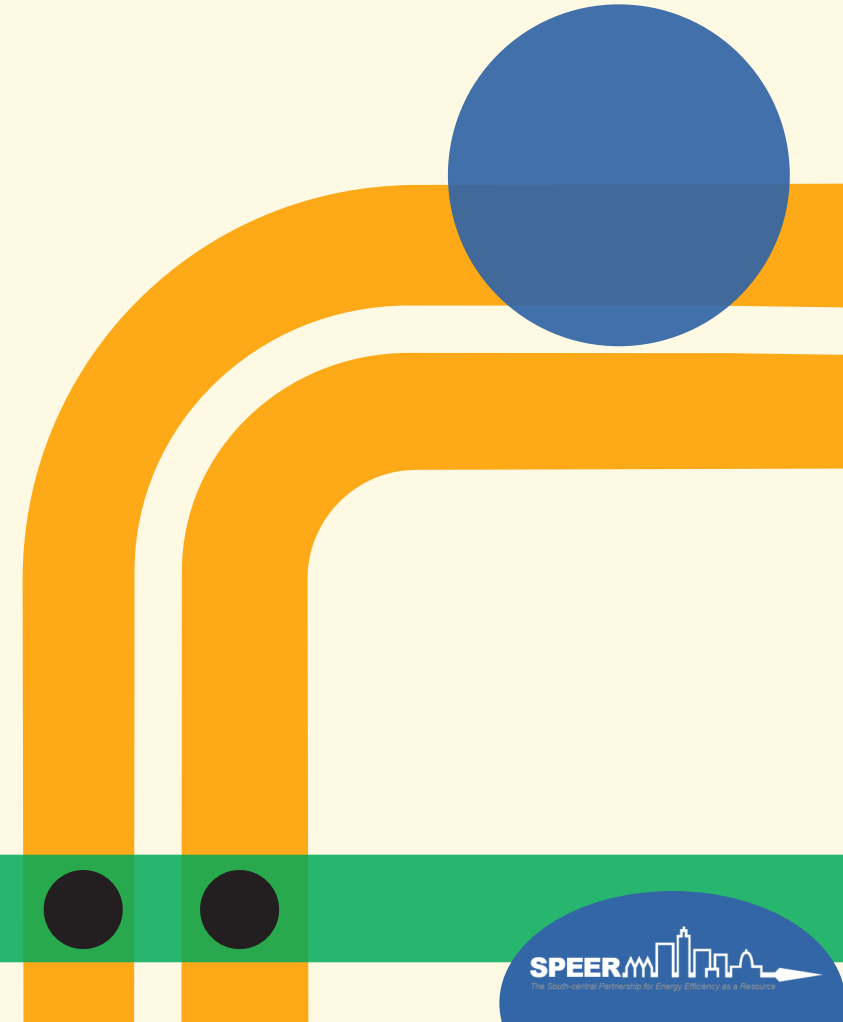
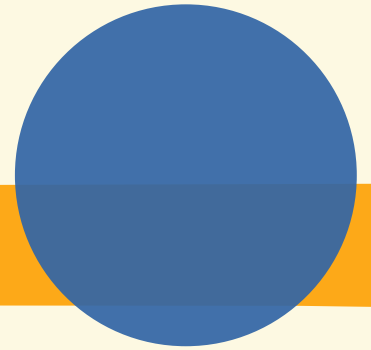




C402.1.2.1 – Methods of Determining *U*-, *C*- and *F*-Factors

Sections Include:

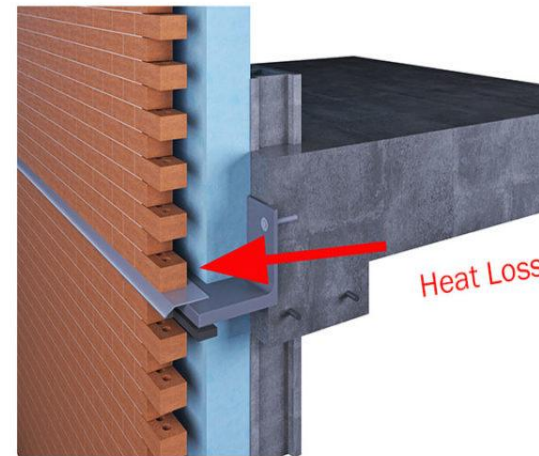
- **C402.1.2.1.1 – Tapered, above-deck insulation based on thickness**
- **C402.1.2.1.2 – Suspended ceilings**
- **C402.1.2.1.3 – Concrete masonry units, integral insulation**
- **C402.1.2.1.4 – Mass walls and floors**
- **C402.1.2.1.5 – Area-weighted averaging of above-grade wall *U*- factors**
- **C402.1.2.1.6 – Cold formed steel assemblies**
- **C402.1.2.1.7 – Spandrel**
- **C402.1.2.1.8 – Mechanical equipment penetrations**



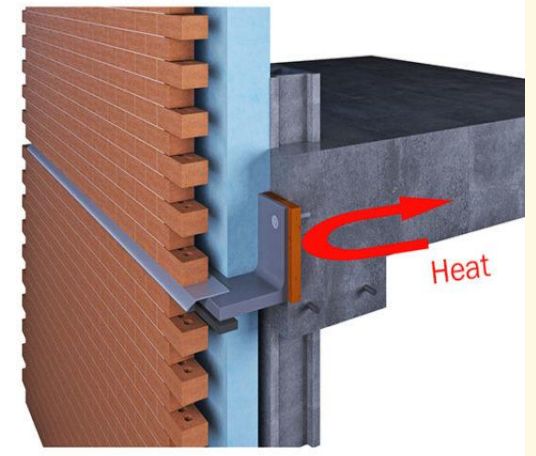


C402.1.4 – Component Performance Method

- **Provides an alternate compliance path for the commercial building envelope**
- **Uses a U-factor/factor trade-off method – allows trading higher insulation in one component for lower in another if overall performance meets the code target**
- **Must use approved calculations or modeling to show compliance**
- **Offers design flexibility and potential cost savings while maintaining total envelope efficiency**



Without Thermal Break



With Thermal Break



C402.6.1.2.2 – Electrical and Communication Boxes



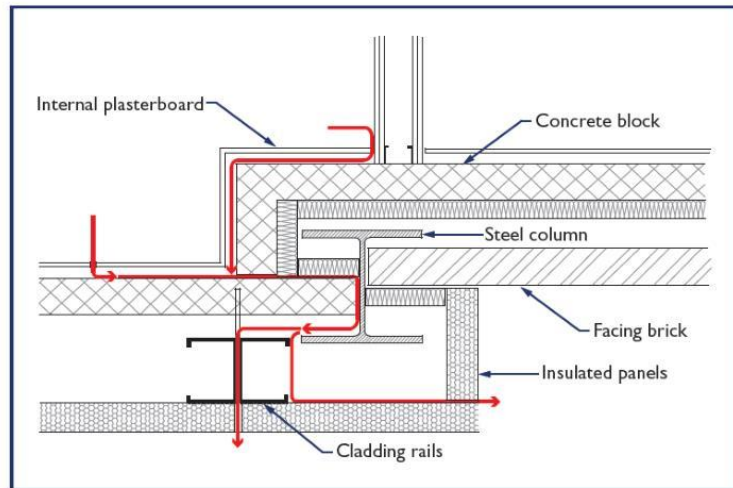
- **Air-sealed boxes that penetrate the building thermal envelope **MUST** be appropriately sealed to the air barrier **OR** comply with NEMA OS4**



Understanding Air Leakage

What is air leakage?

Air leakage paths are quite often tortuous – air may travel some distance through the building fabric between the points of entry and exit.



Making buildings better

BSRIA
Compliance

- **Air Leakage Target:**
 - **0.35 cfm/ft² of enclosure area tested @ 75 Pa**
- **Enclosure area includes:**
 - **Walls**
 - **Ceilings**
 - **Floors**



C402.6.2 Air Leakage Compliance

- **C402.6.2 – Not greater than 0.35 cubic ft per sq ft of the building enclosure area - @75pa**
- **C402.6.2.1 – Whole-building testing**
- **C402.6.2.2 – Dwelling and Sleeping Units testing**
- **C402.6.2.3 – Envelope design and construction verification criteria**
- **Sampling Protocol**
- **Exceptions**





Exceptions

- **Air leakage testing may not apply to:**
- **Small buildings**
- **Certain warehouse spaces**
- **Buildings with limited conditioned spaces**





Whole-Building Testing



- **C402.6.2.1 – Method**
- **Pressurization or depressurization testing**
- **Building envelope tested as a system**
- **Must meet 0.35 cfm/ft² @75 pa**



Dwelling & Sleeping Unit Testing

- **C402.6.2.2 – Applies to:**
- **Hotels**
- **Apartments**
- **Dormitories**
- **Other sleeping units**





Envelope Design & Construction Verification

- **Alternative to Testing**
- **Requires verification of:**
 - **Continuous air barrier installed**
 - **All Penetrations sealed**
 - **Envelope transitions detailed**





C403.1 – Building Mechanical Systems



Mechanical systems and equipment serving the building heating, cooling, ventilation or refrigerating needs shall comply with one of the following:

1. Section C403.1.1 and Section C403.2 – C403.17

2. Data centers shall comply with Section C403.1.1, Section C403.1.2 and Sections C403.6 – C403.17

3. Section C409



C403.4.7 – Heating and Cooling System Controls for Operable Openings to the Outdoors

All doors from a conditioned space to the outdoors and all other operable openings from a conditioned space to the outdoors that are larger than 40 sq ft when fully open shall have automatic controls interlocked with the heating and cooling system. The controls shall be configured to do the following within 5 minutes of opening:

- 1. Disable mechanical heating to the zone or reset the space heating temperature setpoint to 55°F or less**
- 2. Disable mechanical cooling to the zone or reset the space cooling temp setpoint to 90°F or more. Mechanical cooling can remain enabled if the outdoor air temp is below the space temperature**

There are multiple exceptions



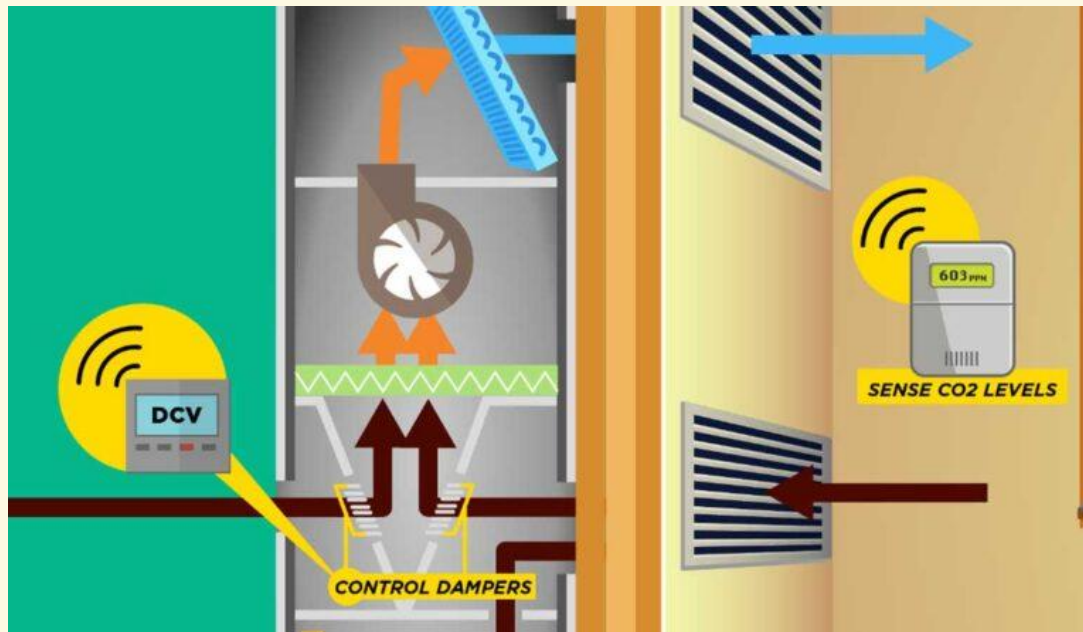


C403.4.8 – Humidification and Dehum controls

- **Controls:**
 - **C403.4.8.1 Dehum – Humidistatic controls shall not use mechanical cooling to reduce the humidity below the lower of a dew point of 55°F or relative humidity of 60% in the coldest zone. Lower humidity shall be permitted where mechanical cooling is being used for temperature control**
 - **C403.4.8.2 Humidification – Humidistatic controls shall not use fossil fuels or electricity to produce relative humidity above 30% in the warmest zone**
 - **C403.4.8.3 Control Interlock – Where a zone is served by a system with both hum and dehum, means such as limit switches, mechanical stops, or for DDC systems, software programming, shall be provided capable of and configured to prevent simultaneous operation of hum and dehum equipment**



C403.7.1 – Demand Control Ventilation



- **DCV shall be provided for the following:**
- **Spaces with ventilation provided by single-zone systems where an air-side economizer is provided**
- **There are exceptions**



C403.7.8 Occupied Standby Controls



- **Zones that contain spaces required to have lighting occupancy sensors must also have controls that reduce ventilation air to zero (or minimum) when occupied**
- **The system must deploy “occupied/standby” mode when occupancy sensors detect no presence, the system shall: (a) setback heating or cooling setpoints, and (b) shut off or reduce supply airflow to the zone**
- **Applies to mechanical ventilation systems serving zones where lighting occupancy sensors are required – effectively linking ventilation control to occupancy sensing to reduce energy use during unoccupied periods**
- **Intended to lower energy consumption by reducing unnecessary ventilation when spaces are unoccupied. This represents a shift toward a more responsive, occupancy-based HVAC control in commercial buildings**



C403.8.5 – Low-Capacity Ventilation Fans

- **Applies to ventilation fans with design airflow less than the threshold specified for larger systems**
- **Requires these low-capacity fans to meet minimum efficiency and control requirements**
- **Ensures that even smaller ventilation fans don't bypass efficiency expectations**
- **Supports overall building energy savings by addressing a category sometimes overlooked**





C403.9 – Large-Diameter Ceiling Fans



- **Applies to fans 84 ½ blade span or greater**
- **Required them to meet specified performance**
- **Ensures that even very large fans meet efficiency**
- **Supports improved energy savings for large open-space buildings**



C403.15 – Dehum in Spaces for Plant Growth and Maintenance

- **Applies to indoor spaces used for plant growth and maintenance**
- **Requires dehum equipment to meet one of 4 options**
- **Purpose: control humidity efficiently in high-moisture, high-load agricultural zones**





C403.17 – Clean Water Pumps



- **Applies to clean-water circulation pumps**
- **Pumps must meet a minimum Pump Energy Index (PEI) rating not greater than 1.0**
- **Purpose is to align with federal efficiency levels**
- **Encourages high-efficiency motors and pump hydraulics**



C404.2.1 – High-Input Service Water-Heating Systems

- **Applies when service-water heating systems use high-input equipment**
- **Sets performance standards**
- **Encourages usage of higher-efficiency technologies**
- **Ensures large service water systems are not allowed to operate at lower efficiency simply because of their size**





C404.4 – Service Water-Heating System Piping Insulation

C404.4 Insulation of Piping (service water heating)

- New requirements for insulating such piping
- 7 exceptions apply

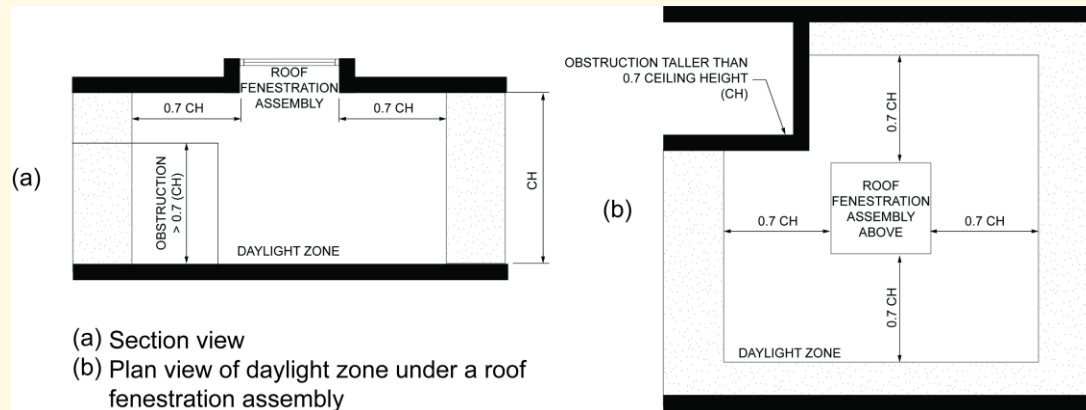


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- **Requires all service hot-water and chilled-water piping to be surrounded by un-compressed insulation**
- **Insulation thickness is specified in Table C404.4.1 based on pipe size and temperature**
- **Exceptions apply where pipe is in conditioned space**
- **Applies to new systems & includes both supply and return piping**



C405.2.8.1 – Demand Responsive Lighting Controls Function



- **Requires interior lighting systems in certain buildings to respond to a demand-response signal**
- **When this occurs, lighting must reduce controlled lighting to 80% or less of full power within 15 minutes**
- **After the event ends, lighting must automatically return to normal operation without manual intervention**
- **Enhances lighting control requirements**



C405.2.10, C405.3.3 – Lighting and Switched Receptacles for Sleeping and Dwelling Units

- **Applies to sleeping units / dwelling units**
- **Requires lighting controls and switched receptacles in each unit: controls must turn off all lighting and switched receptables within 20 minutes**
- **Requires at least two 125 V-15/20 Amp switched receptables in each room**





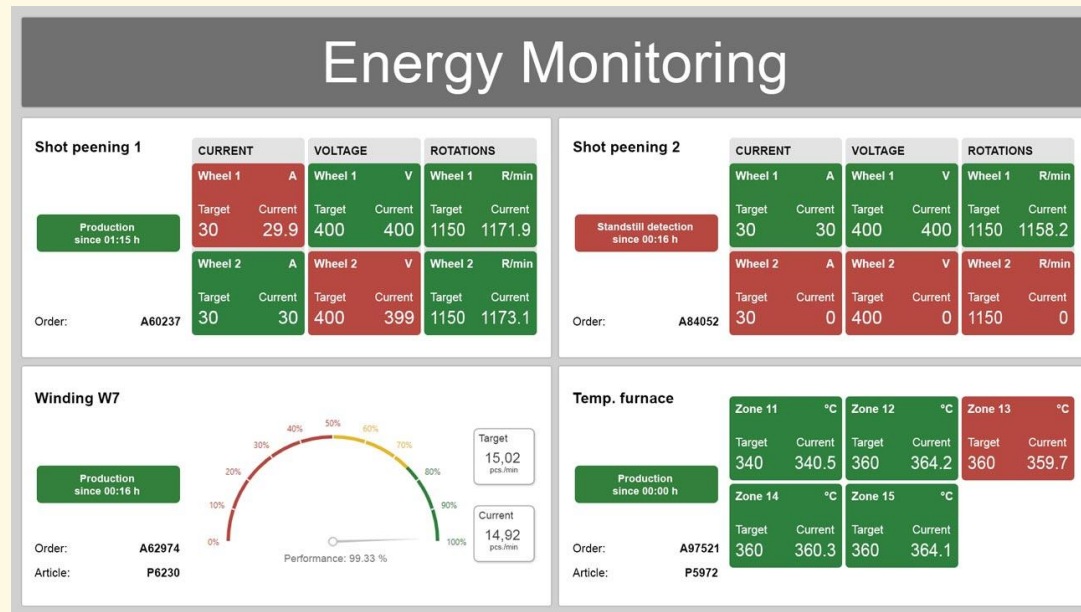
C405.4 – Horticultural Lighting



- **Applies to lighting used for plant growth & maintenance**
- **Requires at least 95% meet minimum photosynthetic photon efficacy (PPE) threshold**
- **Controls required: must have automatic shutdown when sufficient daylight is available**
- **Ensures that high-use, high-intensity plant-growth lighting does not bypass efficiency and control expectations**



C405.13 – Energy Monitoring



- **New buildings with gross conditioned floor area not less than 10,000 sq ft must**
- **Requires sub-meter of major end-uses**
- **Meters must support automated data communication**
- **Helps building owners and operators track energy performance, identify inefficiencies, and supports compliance with benchmarking ordinances**



C405.15 – Renewable Energy Systems

- **Requires on-site renewable electricity generation sized at a minimum rate of .75 W per sq ft or off-site procurement**
- **Establishes exemption/alternate options**
- **Encourages building-scale integration as part of energy code compliance rather than optional add-on**
- **Supports broader shift toward grid-interactive and zero-carbon readiness**





C406.1 - Compliance



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- **Requires buildings to earn a minimum number of energy-efficiency credits from Section C406**
- **Measures options like lighting power reduction, advanced controls, energy monitoring, demand-response, and renewables**
- **Credit system adds a layer of performance over prescriptive baseline**
- **Compliance must include documentation showing credits selected and verification of each measure's performance**



C406.1.1, C406.2 – Additional Energy Efficiency Credits

TABLE C406.1.1(1) ENERGY CREDIT REQUIREMENTS BY BUILDING OCCUPANCY GROUP

BUILDING OCCUPANCY GROUP	CLIMATE ZONE																		
	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R-2, R-4 and I-1	65	66	67	77	80	86	80	81	90	86	90	90	86	90	90	70	89	80	78
I-2	43	42	38	37	36	38	32	32	30	36	36	35	43	43	44	46	47	50	53
R-1	63	62	66	65	70	71	77	80	84	81	83	88	85	86	90	83	87	87	85
B	62	62	64	66	66	65	64	64	68	70	72	74	71	73	77	71	74	74	71
A-2	70	70	72	72	75	75	70	73	82	69	74	78	67	72	78	60	67	57	51
M	80	79	83	79	81	84	67	74	87	80	66	65	79	62	50	75	67	75	58
E	56	57	55	58	58	57	59	62	59	61	66	62	64	67	67	65	67	63	58
S-1 and S-2	61	60	61	60	58	57	44	54	62	85	68	75	90	82	72	90	89	90	90
All other	31	31	31	32	32	33	30	32	36	35	35	35	37	36	36	36	37	36	34

TABLE C406.1.1(2) LIMIT TO ENERGY EFFICIENCY CREDIT CARRYOVER FROM RENEWABLE AND LOAD MANAGEMENT CREDITS

BUILDING OCCUPANCY GROUP	CLIMATE ZONE																			
	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8	
R-2, R-4 and I-1	5	5	5	5	5	5	5	24	19	5	22	18	5	5	19	5	5	5	5	
I-2	16	14	11	8	6	5	5	10	6	8	14	10	17	26	29	21	21	22	39	
R-1	7	5	8	5	19	5	32	40	41	24	41	42	17	37	41	5	24	15	22	
B	7	5	5	8	6	6	14	26	31	23	39	34	19	35	45	5	19	17	27	
A-2	18	16	14	15	13	9	11	23	32	5	23	23	5	5	26	5	5	5	5	
M	5	5	5	5	5	5	5	5	20	5	5	5	5	5	5	5	5	5	5	
E	13	13	18	16	17	14	21	35	40	25	43	29	23	32	27	11	17	25	5	
S-1 and S-2	5	5	5	5	5	5	5	5	13	5	17	20	5	35	23	5	5	11	40	
All other	5	5	5	5	5	5	5	7	17	5	10	7	5	6	11	5	5	5	5	

- **Projects must earn a minimum efficiency credits according occupancy group and climate zone**
- **Mixed-occupancy must compute a floor-area-weighted average of credits**
- **Specific exceptions apply**
- **Enables performance-based compliance path**



C406.1.2, C406.3 – Additional Renewable and Load Management Credits

TABLE C406.1.2 RENEWABLE AND LOAD MANAGEMENT CREDIT REQUIREMENTS BY BUILDING OCCUPANCY GROUP

BUILDING OCCUPANCY GROUP	CLIMATE ZONE																		
	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R-2, R-4 and I-1	34	37	31	46	48	56	49	56	38	31	42	32	26	33	34	23	27	25	25
I-2	23	24	25	25	25	28	26	30	22	25	32	24	25	28	29	26	28	22	20
R-1	30	28	35	30	34	36	34	37	41	32	37	27	28	33	32	25	29	22	18
B	38	39	45	42	45	49	47	56	57	44	55	42	38	47	46	38	45	38	31
A-2	8	8	9	9	8	9	9	11	13	8	11	9	8	10	9	8	9	8	3
M	32	32	42	37	39	47	44	58	57	42	54	46	38	48	5	42	45	38	34
E	27	34	38	37	39	47	44	58	57	42	54	46	38	48	50	42	45	38	34
S-1 and S-2	89	90	90	90	90	90	90	90	90	90	90	90	70	90	90	84	86	71	54
All other	35	39	46	42	46	52	49	56	56	40	52	42	37	44	44	36	39	32	28

- Provides a menu of eligible renewable-energy and load-management measures
- Examples include on-site-renewable generation, off-site renewable procurement, energy storage, demand-response lighting or HVAC controls
- Projects select from the list to accumulate required number of credits
- Supports transition toward net-zero and grid-interactive buildings



C407.2 – Mandatory Requirements

- **Applies when using Simulated Building Performance option**
- **Proposed design must satisfy all requirements listed**
- **Proposed design annual energy cost must be less than or equal to the required percentage reduction compared to standard reference design**
- **On-site renewable energy may count toward the proposed design ONLY up to 5%**

TABLE C407.2(1) REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

SECTION ^a	TITLE
Envelope	
C401.3	Building thermal envelope certificate
C402.2.1.1	Joints staggered
C402.2.1.2	Skylight curbs
C402.2.6	Insulation of radiant heating system panels
C402.6	Air leakage—building thermal envelope
Mechanical	
C403.1.1	Calculation of heating and cooling loads
C403.1.2	Data centers
C403.2	System design
C403.3	Heating and cooling equipment efficiencies
C403.4.1	Thermostatic controls
C403.4.2	Off-hour controls
C403.4.7	Heating and cooling system controls for operable openings to the outdoors
C403.5.5	Economizer fault detection and diagnostics
C403.7, except C403.7.4.1	Ventilation and exhaust systems
C403.8, except C403.8.6	Fan and fan controls
C403.9	Large-diameter ceiling fans
C403.12, except C403.12.3	Refrigeration equipment performance
C403.13	Construction of HVAC system elements
C403.14	Mechanical systems located outside of the building thermal envelope
C404	Service water heating
C405, except C405.3	Electrical power and lighting systems
C406.1.2	Additional renewable and load management credit requirements
C408	Maintenance information and system commissioning



C407.4 – Building Specifications



- **Applies when using Simulated Building Performance Path**
- **Requires documentation of detailed building specs: envelope assemblies, HVAC, water-heating, lighting, controls, and internal loads**
- **Proposed building inputs must model the actual design specs and verify that these match documented inputs used**
- **Ensures the model fidelity is maintained**



C408.2 – Mechanical and SWH Systems Commissioning

- **Applies to mechanical (HVAC) and service-water-heating (SWH)**
- **Requires a commissioning plan, functional testing, and completion report to verify systems operate as designed**
- **Exceptions: under 10,000 sq ft and all systems are under 960,000 btu/h**
- **Ensures all systems match design specs and perform efficiently**





C408.3.1 – Functional Testing

Permanently Marked Receptacles
for Automatic Outlet Control Systems

HUBBELL
Wiring Device-Kelowna



- Permanent power symbol remains clearly visible after installation
- Control both outlets per device for 100% controlled applications or just one outlet for 50% controlled applications
- Ideal for commercial buildings, retail, schools, hotel rooms
- Available in SNAPConnect® and conventionally wired versions
- Part of the Hubbell Load:Logic™ Plug Control system. Visit www.hubbell-wiring.com for details



Hubbell permanently marked receptacles for automatic outlet control systems are embossed with the universally recognized power symbol and the word "CONTROLLED." These markings clearly identify which convenience outlets are turned off when the workspace is vacant.



Automatic Outlet Control systems are required for at least 50% of the receptacles installed in private offices, open offices, and computer classrooms

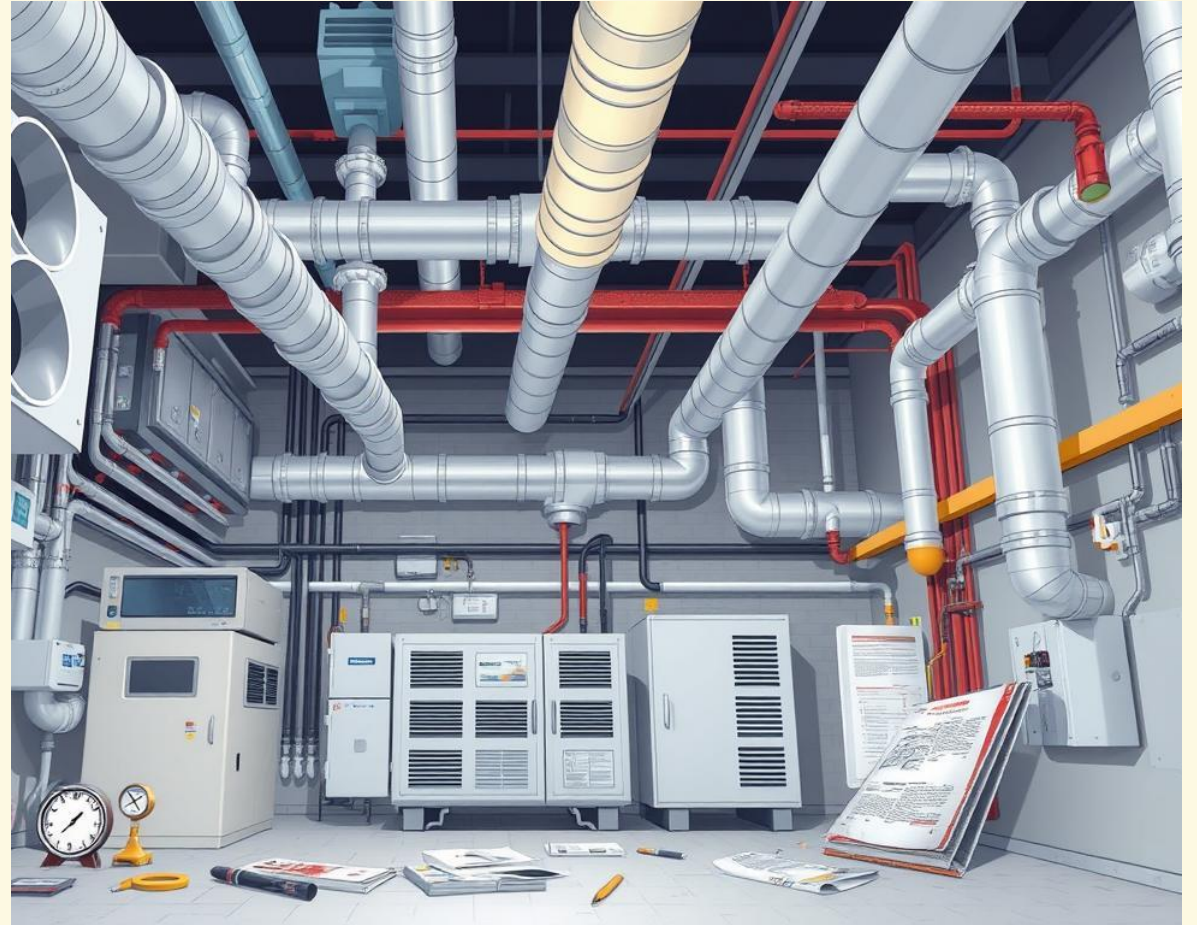
HUBBELL

- **Requires building systems to undergo specified functional tests to confirm they operate as intended**
- **Coverage includes occupant sensors, time-switches, daylight responsive controls, and automatic receptacles**
- **Tests must verify calibration, programming, adjustment, and correct hardware/software operation**
- **Documentation of testing results is required and provided to owner/operator**



C409.1 – C409.3 – HVAC TSPR Compliance

- **Sections C409.1-C409.3 define purpose, scope, and defines the new HVAC TSPR compliance path**
- **C409.1 – Purpose: Establishes the TSPR metric to compare annual heating + cooling load to annual HVAC system energy use**
- **C409.2 – Scope: Applies to certain building types when using eligible HVAC systems**
- **C409.3 – Definitions: Provides key definitions such as “HVAC Total System Performance Ratio (TSPR)”, “Proposed Design”, “Standard Reference Design”**



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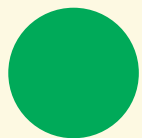


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Any Questions?

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