

# The 2023 Florida Energy Conservation Code past, present, and future

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# Learning Objectives

- Description: this course will cover the significant updates to the 2023 Florida Energy Conservation Code and compare it to the 2021 IECC and the upcoming 2024 IECC .
- Learning Objectives
  - Participants will be made aware of significant updates to the 2023 Florida Energy Conservation Code for the 2020 version.
  - Compare the 2023 Florida Energy Conservation Code to the 2021 IECC
  - Review the new scope and intent of the 2024 IECC
  - Overview of Proposed changes for the 2024 IECC and participants will be made aware of future advancements in the code.

# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

- Identify the compliance path

## 2023 FBC Energy Conservation

### C103.2 Information on construction documents.

Construction documents shall be drawn to scale upon suitable material. Electronic media documents approved by the code official. Construction documents shall be of sufficient clarity to indicate proposed, and show in sufficient detail pertinent data and features of the building, systems and equipment shall include, but are not limited to, the following as applicable:

1. Insulation materials and their R-values.
2. Fenestration (U-factor and solar heat gain coefficient) (SHGCs)
3. Area weighted U-factor and solar heat gain coefficient (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water heating system and equipment types, sizes and efficiencies.
6. Economizer description.
7. Equipment and system controls.
8. Fan motor horsepower (hp) and controls.
9. Duct sealing, duct and pipe insulation and location.
10. Lighting fixture schedule with wattage and control narrative.
11. Location of daylight zones on floor plans.
12. Air sealing details.

### C103.2.1 Building thermal envelope depiction.

The building's thermal envelope shall be represented on the construction drawings.

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1. Energy compliance path.
2. Insulation materials and their R-values.
3. Fenestration U-factors and solar heat gain coefficients (SHGCs).
4. Area weighted U-factor and solar heat gain coefficient (SHGC) calculations.
5. Mechanical system design criteria.
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- Joist framing change in CZ 1-2 within table C402.1.3

## 2023 FBC Energy Conservation

TABLE C402.1.3 OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD<sup>3</sup>

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
	Roofs															
Mass <sup>a</sup>	NR	NR	R 6.0 <sub>ci</sub>	R 6.0 <sub>ci</sub>	R 10 <sub>ci</sub>	R 10 <sub>ci</sub>	R 10 <sub>ci</sub>	R 10.4 <sub>ci</sub>	R 10 <sub>ci</sub>	R 12.0 <sub>ci</sub>	R 12.0 <sub>ci</sub>	R 12.0 <sub>ci</sub>	R 15 <sub>ci</sub>	R 15.7 <sub>ci</sub>	R 15 <sub>ci</sub>	R 15.7 <sub>ci</sub>
Joist framing	R-13	R-13	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30
	Slab-on-grade floors															

## 2020 FBC Energy Conservation

Mass <sup>a</sup>	NR	NR	R-8.9 <sub>ci</sub>	R-8.9 <sub>ci</sub>	R-10 <sub>ci</sub>	R-10 <sub>ci</sub>	R-10 <sub>ci</sub>	R-10.4 <sub>ci</sub>	R-10 <sub>ci</sub>	R-12.0 <sub>ci</sub>	R-12.0 <sub>ci</sub>	R-12.0 <sub>ci</sub>	R-15 <sub>ci</sub>	R-16.7 <sub>ci</sub>	R-15 <sub>ci</sub>	R-16.7 <sub>ci</sub>
Joist framing	NR	NR	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30 <sup>f</sup>	R-30 <sup>f</sup>	R-30 <sup>f</sup>	R-30 <sup>f</sup>	R-30 <sup>f</sup>
	Slab-on-grade floors															
Unheated slabs	NR	NR	NR	NR	NR	NR	R 10 for 24" below	R 10 for 24" below	R 10 for 24" below	R 10 for 24" below	R 10 for 24" below	R 15 for 24" below	R 15 for 24" below	R 15 for 24" below	R 15 for 24" below	R 20 for 24" below
Heated slabs <sup>d</sup>	R 7.5 for 12" below	R 7.5 for 12" below	R 7.5 for 12" below	R 7.5 for 12" below	R 10 for 24" below	R 10 for 24" below	R 15 for 24" below	R 15 for 24" below	R 15 for 36" below	R 15 for 36" below	R 15 for 36" below	R 20 for 48" below	R 20 for 24" below	R 20 for 48" below	R 20 for 48" below	R 20 for 48" below

# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

- Roof solar reflectance increased in Climate Zone 1A

## 2023 FBC Energy Conservation

TABLE C402.3 MINIMUM ROOF REFLECTANCE AND EMITTANCE OPTIONS<sup>11</sup>

Three-year aged solar reflectance <sup>b</sup> of 0.55 (0.68 for Climate Zone 1A) and 3-year aged thermal emittance <sup>c</sup> of 0.75
Three-year aged solar reflectance index <sup>d</sup> of 64 (75 for Climate Zone 1A)

- The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for either solar reflectance or thermal emittance shall be assigned both a 3-year-aged solar reflectance in accordance with [Section C402.3.1](#) and a 3-year-aged thermal emittance of 0.90.
- Aged solar reflectance tested in accordance with [ASTM D1549](#), [ASTM F903](#), or [ASTM F1916](#) or [CRRC-1 Standard](#).
- Aged thermal emittance tested in accordance with [ASTM C1371](#) or [ASTM F408](#) or [CRRC-1 Standard](#).
- Solar reflectance index (SRI) shall be determined in accordance with [ASTM E1889](#) using a correction coefficient of 2.1 (Sub- $\theta^2$  -  $10^3$ W/m<sup>2</sup> - K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance.

## 2020 FBC Energy Conservation

TABLE C402.3 MINIMUM ROOF REFLECTANCE AND EMITTANCE OPTIONS<sup>8</sup>

Three-year aged solar reflectance <sup>b</sup> of 0.55 and 3-year aged thermal emittance <sup>c</sup> of 0.75
Three-year aged solar reflectance index <sup>d</sup> of 64

- The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for either solar reflectance or thermal emittance shall be assigned both a 3-year-aged solar reflectance in accordance with [Section C402.3.1](#) and a 3-year-aged thermal emittance of 0.90.
- Roof solar reflectance tested in accordance with [ASTM D1549](#), [ASTM F903](#) or [ASTM F1916](#) or [CRRC-1 Standard](#).
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# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

- Building Envelope Fenestration Maximum U-factor and SHGC requirements

2020 FBC Energy Conservation

CLIMATE ZONE	1		2	
<b>U-factor</b>				
Fixed fenestration	0.50		0.50	
Operable fenestration	0.65		0.65	
Entrance doors	1.10		0.83	
<b>SHGC</b>				
Orientation <sup>a</sup>	SFW	N	SFW	N
$1^{\circ} < \theta < 0.2$	0.25	0.33	0.25	0.33
$0.2 \leq \theta < 0.5$	0.30	0.37	0.30	0.37
$\theta \geq 0.5$	0.40	0.40	0.40	0.40
U-factor	0.75		0.65	
SHGC	0.35		0.35	

2023 FBC Energy Conservation

CLIMATE ZONE	1		2	
<b>U-factor</b>				
Fixed fenestration	0.50		0.50	
Operable fenestration	0.65		0.65	
Entrance doors	1.10		0.83	
<b>SHGC</b>				
Orientation <sup>a</sup>	SFW	N	SFW	N
$1^{\circ} < \theta < 0.2$	0.25	0.33	0.25	0.33
$0.2 \leq \theta < 0.5$	0.30	0.37	0.30	0.37
$\theta \geq 0.5$	0.40	0.40	0.40	0.40
U-factor	0.75		0.65	
SHGC	0.35		0.35	

2021 IECC

CLIMATE ZONE	0 AND 1		2	
<b>U-factor</b>				
Fixed fenestration	0.50		0.45	
Operable fenestration	0.60		0.60	
Entrance doors	0.83		0.77	
<b>SHGC</b>				
	Fixed	Operable	Fixed	Operable
$\theta < 0.2$	0.23	0.21	0.25	0.23
$0.2 < \theta < 0.5$	0.28	0.26	0.30	0.28
$\theta \geq 0.5$	0.37	0.34	0.40	0.37
U-factor	0.70		0.65	
SHGC	0.30		0.30	

# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

- Commercial air leakage requirements- air barrier meet materials and assemblies or test. alternate provided and added exception language

## 2023 FBC Energy Conservation

### C402.5.1.2 Air barrier compliance.

A continuous air barrier for the opaque building envelope shall comply with the following:

1. Buildings or portions of buildings, including Group R and Group I occupancies, shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.
2. Buildings or portions of buildings other than Group R and Group I occupancies shall meet the provisions of Section C402.5.1.2.3.

#### Exceptions:

1. Buildings in Climate Zones 2B, 3B, 3C and 5C.
2. Buildings larger than 5,000 square feet (465 m<sup>2</sup>) floor area in Climate Zones 0B, 1, 2A, 4B and 4C.
3. Buildings between 5,000 and 50,000 square feet (465 and 4645 m<sup>2</sup>) floor area in Climate Zones 0A, 3A and 5B.
3. Buildings or portions of buildings other than Group R and Group I occupancies that do not complete air barrier testing shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.

- Group R and I material and assemblies. All non-group R and I that don't meet exceptions must test. Those non-group R and I that are excepted must meet material and assemblies.

### C402.5.1.2.8 Building thermal envelope testing.

The building thermal envelope shall be tested in accordance with ASTM E779, ANSI/RESNET/ICC 300, or ASTM E1827 or an equivalent method approved by the code official. The measured air leakage shall not exceed 0.40 cfm/ft<sup>2</sup> (2.0 L/s · m<sup>2</sup>) of the building thermal envelope area at a pressure differential of 0.5 inch water gauge (75 Pa). Alternatively, portions of the building shall be tested and the measured air leakages shall be area-weighted by the surface areas of the building envelope in each portion. The weighted average test results shall not exceed the whole building leakage limit. In the alternative approach, the following portions of the building shall be tested:

1. The entire envelope area of all stories that have any spaces directly under a roof.
2. The entire envelope area of all stories that have a building entrance, exposed floor or loading dock, or are below grade, and
3. Representative above-grade sections of the building totaling at least 25 percent of the wall area enclosing the remaining conditioned space.

**Exception:** Where the measured air leakage rate exceeds 0.40 cfm/ft<sup>2</sup> (2.0 L/s · m<sup>2</sup>) but does not exceed 0.60 cfm/ft<sup>2</sup> (3.0 L/s · m<sup>2</sup>), a diagnostic evaluation using smoke tracer or infrared imaging shall be conducted while the building is pressurized along with a visual inspection of the air barrier. Any leaks noted shall be sealed where such sealing can be made without destruction of existing building components. An additional report identifying the corrective actions taken to seal leaks shall be submitted to the code official and the building owner, and shall be deemed to comply with the requirements of this section.



# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

- Commercial air barrier compliance

## 2020 FBC Energy Conservation-materials and assemblies

### C402.5 Air leakage—thermal envelope (Mandatory).



The thermal envelope of buildings shall comply with [Sections C402.5.1 through C402.5.6](#), or the building thermal envelope shall be tested in accordance with ASTM E779 at a pressure differential of 0.9 inch water gauge (75 Pa) or an equivalent method approved by the code official and deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope is not greater than 0.40 cfm/100<sup>2</sup> (2.0 L/s · m<sup>2</sup>). Where compliance is based on such testing, the building shall also comply with [Sections C402.5.5](#), [C402.5.6](#) and [C402.5.7](#).

### C402.5.1.2 Air barrier compliance options.

A continuous air barrier for the opaque building envelope shall comply with [Section C402.5.1.2.1](#) or [C402.5.1.2.2](#).

# LET'S PLAY DOES THIS BUILDING HAVE TO TEST!

Select

Code Edition

IECC Compliance Path

Climate Zone

Occupancy

Square Footage

Is Air Leakage Testing required for this example?

# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

New in 2023 FBC Energy Conservation- (glitch in reference)

## **C402.5.10 Electrical and communication boxes.**

Electrical and communication boxes that penetrate the air barrier of the building thermal envelope, and that do not comply with Section C402.5.11.1, shall be caulked, taped, gasketed or otherwise sealed to the air barrier element being penetrated. All openings on the uncaulked portion of the box shall be sealed. Where present, insulation shall rest against all uncaulked portions of the box.

### **C402.5.10.1 Air-sealed boxes.**

Where air-sealed boxes are installed, they shall be marked in accordance with NFPA 704. Air-sealed boxes shall be installed in accordance with the manufacturer's instructions.

# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

## New in 2023 FBC Energy Conservation

### C402.5.11 Operable openings Interlocking (Mandatory).

Where occupancies utilize operable openings to the outdoors that are larger than 40 square feet in area, such openings shall be interlocked with the heating and cooling system so as to raise the cooling setpoint to 90 degrees and lower the heating setpoint to 55 degrees whenever the operable opening is open. The change in heating and cooling setpoints shall occur within 10 minutes of opening the operable opening.

#### Exceptions:

1. Separately zoned areas associated with the preparation of food that contributes to the IMAC loads of a restaurant or similar type of
2. Warehouses that utilize overhead doors for the function of the occupancy, where approved by the code official
3. The final entrance doors where located in the exterior wall and are part of a vestibule system

### C402.6.11.1 Operable controls (Mandatory).

Controls shall comply with [Section C403.6](#).

### C403.2.12.6 Large-diameter ceiling fans.

Where provided, large-diameter ceiling fans shall be tested and labeled in accordance with AMCA 230 and shall meet the efficiency requirements of [Table C403.2.12.6](#) and [Section C403.2.12.6.1](#).

**TABLE C403.2.12.6 CEILING FAN EFFICIENCY REQUIREMENTS<sup>a</sup>**

EQUIPMENT TYPE	MINIMUM EFFICIENCY <sup>b,c</sup>	TEST PROCEDURE
Large diameter ceiling fan for applications outside the US <sup>2</sup>	CFFI = 1.00 at high (maximum) speed CFEI = 1.31 at 40% of high speed or the nearest speed that is not less than 40% of high speed	10 CFR 430 Appendix U or AMCA Standard 230 and AMCA Standard 208 (for FCI calculations)

New requirements for low-capacity ventilation fans in C403.2.12.7

# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

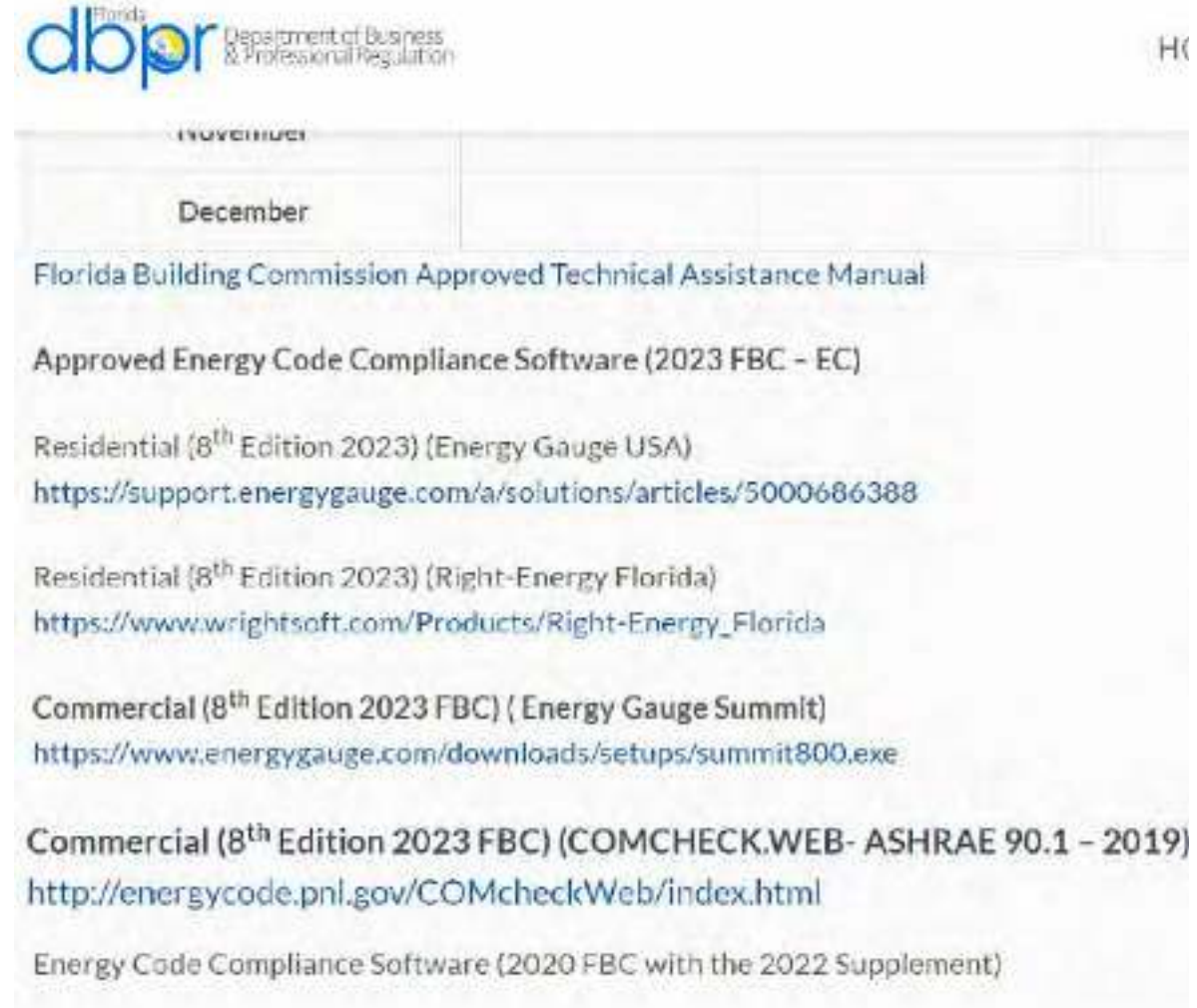
## Mechanical Systems Items of Note:

Currently only Comcheck using ASHRAE 90.1-2019 is available to use for compliance in Florida

FBC did not bring in Mechanical Load Reqs. For Data Centers from ASHRAE 90.4

FBC did not bring in fault detection and diagnostic Requirements for mech system in buildings over 100k sf

FBC did bring in 2019 ASHRAE mechanical tables, Heat pump supplementary heat control reqs.



The screenshot shows the Florida Department of Business & Professional Regulation (dbpr) website. The page is titled "November" and "December". It lists several items related to energy code compliance software and technical assistance manuals. The items are:

- Florida Building Commission Approved Technical Assistance Manual
- Approved Energy Code Compliance Software (2023 FBC - EC)
- Residential (8<sup>th</sup> Edition 2023) (Energy Gauge USA)  
<https://support.energygauge.com/a/solutions/articles/5000686388>
- Residential (8<sup>th</sup> Edition 2023) (Right-Energy Florida)  
[https://www.wrightsoft.com/Products/Right-Energy\\_Florida](https://www.wrightsoft.com/Products/Right-Energy_Florida)
- Commercial (8<sup>th</sup> Edition 2023 FBC) ( Energy Gauge Summit)  
<https://www.energygauge.com/downloads/setups/summit800.exe>
- Commercial (8<sup>th</sup> Edition 2023 FBC) (COMCHECK.WEB- ASHRAE 90.1 - 2019)  
<http://energycode.pnl.gov/COMcheckWeb/index.html>
- Energy Code Compliance Software (2020 FBC with the 2022 Supplement)

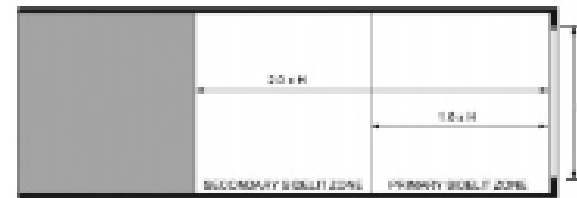
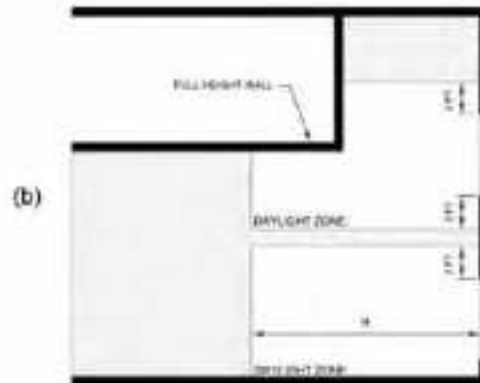
# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

FBC brought in new occupant sensor control function requirements in warehouse storage areas. Also brought in 2021 IECC light-reduction control function requirements. Updated lighting time-switch control function requirements to the 2018 IECC.

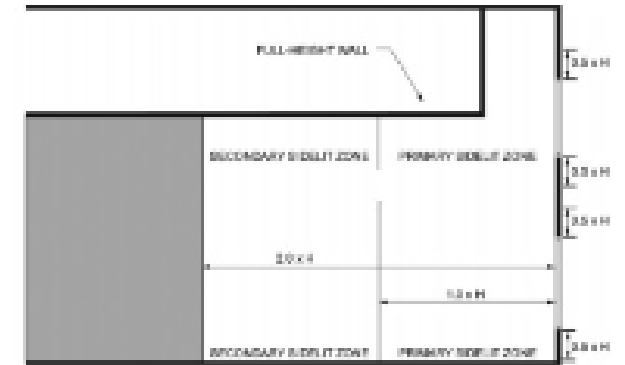
Updated daylight-responsive control functions and sidelit daylight zone requirements, but secondary sidelit daylight zone not added to meet 2021 IECC.



(a) Section view and  
(b) Plan view of daylight zone adjacent to fenestration in a wall



(c) Section view



(d) Plan view

**.2.4.2(1) PRIMARY AND SECONDARY SIDELIT DAYLIGHT ZONES**

# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

Lighting items of Note:

Parking garage lighting control by occupant sensor or time-switch control with exceptions

Updates to interior lighting power allowance tables for both building area method and space by space method to match 2021 IECC. No changes to exterior lighting power allowance.

## 2020 FBC Energy Conservation

BUILDING AREA TYPE	LPD (w/ft <sup>2</sup> )
Automated facilities	0.47
Convention center	0.46
Courthouse	0.40
Energy performance center	0.40
Energy performance lab	0.46
Energy center	0.41
Embassy/AI <sup>1</sup>	0.67
Exhibition center	0.46
Health club <sup>2</sup>	0.53
Hotel/motel	0.61
Health care clinic	0.82
Health care <sup>3</sup>	1.00

## 2023 FBC Energy Conservation

BUILDING AREA TYPE	LPD (w/ft <sup>2</sup> )
Automated facilities	0.55
Convention center	0.64
Courthouse	0.70
Energy performance center	0.60
Energy performance lab	0.70
Energy center	0.71
Embassy/AI <sup>1</sup>	0.80
Exhibition center	0.70
Health club <sup>2</sup>	0.60
Hotel/motel	0.66
Health care clinic	0.87
Health care <sup>3</sup>	0.96

# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

Lighting items of Note:

OFFICE 500,000 FT <sup>2</sup>	POST OFFICE 100,000 FT <sup>2</sup>	RETAIL 250,000 FT <sup>2</sup>	EXERCISE CENTER 150,000 FT <sup>2</sup>
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For SI: 1 square foot = 0.0929 m<sup>2</sup>

Commentary Figure C405.3.2(1) MULTIUSE FACILITY

USAGE CATEGORY	GROSS CONDITIONED (LIGHTED) FLOOR AREA (SQ. FT.)		LIGHTING POWER DENSITY (WATTS PER SQUARE FOOT)		LIGHTING POWER ALLOWANCE (WATTS)
Office	500,000	X	0.64	=	320,000
Post office	100,000	X	0.65	=	65,000
Department store—sales and dressing areas	221,000	X	0.84	=	185,640
Department store—warehouse	29,000	X	0.40	=	11,600
Exercise center	150,000	X	0.72	=	108,000
Total for building	1,000,000	X	—	—	601,600

For SI: 1 square foot = 0.0929 m<sup>2</sup>; 1 watt per square foot = 11 W/m<sup>2</sup>

Commentary Figure C405.3.2(2)

TOTAL LIGHTING POWER ALLOWANCE CALCULATION USING THE BUILDING AREA METHOD

USAGE CATEGORY	GROSS CONDITIONED (LIGHTED) FLOOR AREA (SQ. FT.)		LIGHTING POWER DENSITY (WATTS PER SQUARE FOOT)		LIGHTING POWER ALLOWANCE (WATTS)
Office—enclosed	100,000	X	0.74	=	74,000
Office—open plan	400,000	X	0.61	=	244,000
Post office	100,000	X	0.78	=	78,000
Retail—sales area	220,000	X	1.05	=	231,000
Retail—warehouse	29,000	X	0.33	=	9,570
Retail—dressing area	1,000	X	0.51	=	510
Exercise center—fitness	150,000	X	0.90	=	135,000
Total for building	1,000,000	—	—	—	770,600

For SI: 1 square foot = 0.0929 m<sup>2</sup>; 1 watt per square foot = 11 W/m<sup>2</sup>

Commentary Figure C405.3.2(3)

TOTAL LIGHTING POWER ALLOWANCE CALCULATION USING THE SPACE-BY-SPACE METHOD



# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

Lighting items of Note:

Added requirements for lighting for plant growth and maintenance

Did not add gas lighting appliance requirement to eliminate continuously burning pilot ignition system in 21 IECC

Did not add automatic receptacle control requirements in 21 IECC

Did not add energy monitoring requirements for buildings over 25k of gross conditioned floor area in 21 IECC

Did not add electrical energy metering/end-use metering category requirements. As well as data acquisition systems and graphical energy reporting requirements of the 21 IECC. This is helpful for ahj that have building performance requirements such as the City of Orlando

# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

Items of Note:

Florida did not adopt the mandatory table structure in the 2021 IECC

## 2023 FBC Energy Conservation

**C407.2 Mandatory requirements.**

Compliance with this section requires compliance with [Sections C402.5](#), [C403.2](#), [C404](#), [C405.1](#), [C405.2](#) and [C405.4](#) through [C405.9](#).

## 2021 IECC

TABLE C407.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

SECTION <sup>a</sup>	TITLE
<b>Envelope</b>	
<a href="#">C402.6</a>	Air leakage—thermal envelope
<b>Mechanical</b>	
<a href="#">C403.1.1</a>	Calculation of heating and cooling loads
<a href="#">C403.1.2</a>	Data centers
<a href="#">C403.2</a>	System design
<a href="#">C403.3</a>	Heating and cooling equipment efficiencies
<a href="#">C403.4</a> , except <a href="#">C403.4.3</a> , <a href="#">C403.4.4</a> and <a href="#">C403.4.5</a>	Heating and cooling system controls
<a href="#">C403.5.5</a>	Economizer fault detection and diagnostics



# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

- RESIDENTIAL PROVISIONS

## 2020 FBC Energy Conservation

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### R103.2.1 Building thermal envelope depiction.

The building's thermal envelope shall be represented on the construction documents.

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4. Area weighted U-factor and solar heat gain coefficients (SHGC) calculations.
5. Mechanical system design criteria.
6. Mechanical and service water-heating system and equipment types, sizes and efficiencies
7. Equipment and system controls.
8. Duct sealing, duct and pipe insulation and location
9. Air sealing details.

### R103.2.1 Building thermal envelope depiction.

The building's thermal envelope shall be represented on the construction documents.

# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

- No changes to the R402.1.2 tables

## 2023 FBC Energy Conservation

TABLE R402.1.2 INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT<sup>a</sup>



CLIMATE ZONE	FENESTRATION U-FACTOR <sup>b,1</sup>	SKYLIGHT <sup>b</sup> U-FACTOR	GLAZED FENESTRATION SHGC <sup>b,4</sup>	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE <sup>1</sup>	FLOOR R-VALUE	BASEMENT <sup>c</sup> WALL R-VALUE	SLAB <sup>d</sup> R-VALUE & DEPTH	CRAWL SPACE <sup>e</sup> WALL R-VALUE
1	NR	0.75	0.25	30	13	5/4	13	0	0	0
2	0.40	0.65	0.25	36	13	4/6	13	0	0	0
3	0.35	0.55	0.25	36	20 or 13+5 <sup>b</sup>	6/13	19	5/13 <sup>f</sup>	0	5/13

## 2020 FBC Energy Conservation

TABLE R402.1.2 INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT<sup>a</sup>



CLIMATE ZONE	FENESTRATION U-FACTOR <sup>b,1</sup>	SKYLIGHT <sup>b</sup> U-FACTOR	GLAZED FENESTRATION SHGC <sup>b,4</sup>	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE <sup>1</sup>	FLOOR R-VALUE	BASEMENT <sup>c</sup> WALL R-VALUE	SLAB <sup>d</sup> R-VALUE & DEPTH	CRAWL SPACE <sup>e</sup> WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	30	13	4/6	13	0	0	0
3	0.35	0.55	0.25	30	20 or 13+5 <sup>b</sup>	5/13	19	5/13 <sup>f</sup>	0	5/13

# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

- Air leakage requirements

## 2023 FBC Energy Conservation

### R402.4.1.2 Testing.



The building or dwelling unit shall be tested and verified as having an air leakage rate not exceeding seven air changes per hour in Climate Zones 1 and 2, and three air changes per hour in Climate Zones 3 through 8. Dwelling units with an air leakage rate less than three air changes per hour shall be provided with whole house mechanical ventilation in accordance with [Section M103.6.1](#) of this code and [Section M1307.3](#) of the *Florida Building Code, Residential*. Testing shall be conducted in accordance with [ANSI/ASHRAE/ICC 380](#) and reported at a pressure of 0.2 inch w.g. (50 pascals). Testing shall be conducted by either individuals as defined in Section 553.993(5) or (7), [Florida Statutes](#), or individuals licensed as set forth in Section 489.105(3)(h), (g) or (i) or an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the code official. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope.

## 2020 FBC Energy Conservation

### R402.4.1.2 Testing.



The building or dwelling unit shall be tested and verified as having an air leakage rate not exceeding seven air changes per hour in Climate Zones 1 and 2, and three air changes per hour in Climate Zones 3 through 8. Testing shall be conducted in accordance with [ANSI/ASHRAE/ICC 380](#) and reported at a pressure of 0.2 inch w.g. (50 pascals). Testing shall be conducted by either individuals as defined in Section 553.993(5) or (7), [Florida Statutes](#), or individuals licensed as set forth in Section 489.105(3)(h), (g) or (i) or an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the code official. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope.

# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

- Lighting equipment  
2020 FBC Energy Conservation

## **R404.1 Lighting equipment (Mandatory).**



Not less than 90 percent of the lamps in permanently installed luminaires shall have an efficacy of at least 45 lumens-per-watt or shall utilize lamps with an efficacy of not less than 65 lumens-per-watt.

## 2023 FBC Energy Conservation

### **R404.1 Lighting equipment (Mandatory).**



All permanently installed luminaires, excluding those in kitchen appliances, shall have an efficacy of at least 45 lumens-per-watt or shall utilize lamps with an efficacy of not less than 65 lumens-per-watt.

### **R404.1.1 Lighting equipment (Mandatory).**



Fuel gas lighting systems shall not have continuously burning pilot lights.

# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

- Florida did not pick up mandatory tables for R405 or R406
- 5% reduction of the proposed design to the standard reference design in the Simulated Performance Alternative

## 2023 FBC Energy Conservation

### R405.3 Performance-based compliance.

Compliance based on simulated energy performance requires that a proposed residence (proposed design) be shown to have annual total normalized Modified Loads that are less than or equal to **95 percent** of the annual total loads of the standard reference design as calculated in accordance with Appendix RC of this standard.

## 2020 FBC Energy Conservation

### R405.3 Performance-based compliance.

Compliance based on simulated energy performance requires that a proposed residence (proposed design) be shown to have annual total normalized Modified Loads that are less than or equal to the annual total loads of the standard reference design as calculated in accordance with Appendix RC of this standard.



# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

- No change in the ERI compliance path

## 2023 FBC Energy Conservation

TABLE R406.4 MAXIMUM ENERGY RATING INDEX



CLIMATE ZONE	ENERGY RATING INDEX
1	56
2	56
3	51
4	54

## 2020 FBC Energy Conservation

TABLE R408.4 MAXIMUM ENERGY RATING INDEX



CLIMATE ZONE	ENERGY RATING INDEX
1	58
2	50
3	51
4	51

# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

- No change in the ERI compliance path

## 2023 FBC Energy Conservation-Appendix RF Electric Vehicle Charging

### SECTION RF103 REQUIREMENTS FOR ELECTRIC VEHICLE CHARGING

**RF103.1 New one- and two-family dwellings and townhouses with attached or detached private garages.**

Each dwelling unit with an attached or detached garage shall be designed with provision for future installation of electric vehicle supply equipment in accordance with this section.

**RF103.2 Raceway.**

A listed raceway of minimum trade size 1 shall be installed to accommodate a branch circuit for electric vehicle supply equipment.

The raceway shall originate at the main electrical panel or a property rated sub panel, and terminate in a listed box or enclosure in close proximity to the proposed location of the electric vehicle supply equipment.

The raceway shall be continuous from the point of origin to the termination at the proposed location of the electric vehicle supply equipment.

The enclosure provided for future electric vehicle supply equipment shall be labeled "EV CAPABLE." The label shall comply with [NFPA 70](#) Section 110.21(B).

**RF103.3 Service capacity.**

The electrical panel from which the electric vehicle supply equipment branch circuit originates shall be rated for, and be provided with open space for installation of a two-pole 40 ampere overcurrent protective device. The provided overcurrent device space(s) shall be identified in the panel circuit directory as "EV CAPABLE."

# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

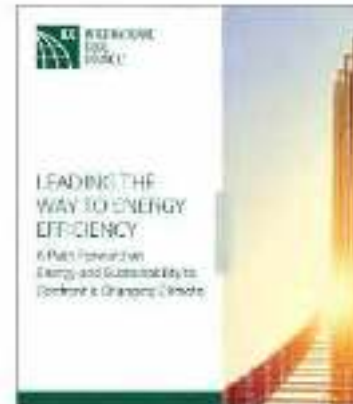
- Florida did not pick up the Additional Energy Efficiency Options R408 from the 2021 IECC
  - Compliance options required selection from one of the following:
    - Enhanced envelope
    - More efficient HVAC equipment
    - Reduced energy use in service water-heating
    - More efficient duct thermal distribution system
    - Improved air sealing and efficient ventilation system

# Leading the Way to Energy Efficiency

- [iccsafe.org/energy](http://iccsafe.org/energy)



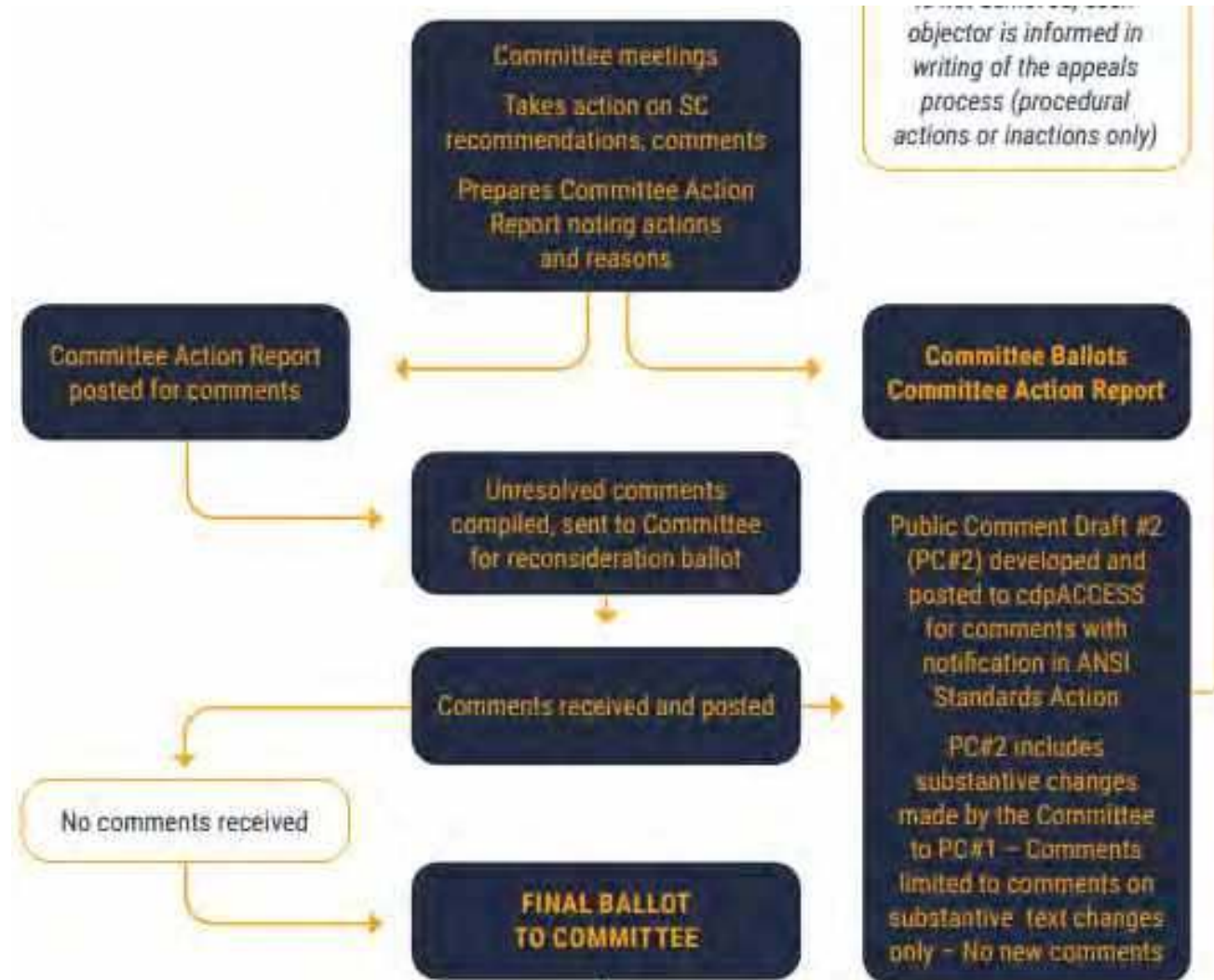
The International Code Council family of solutions is helping our communities forge a path forward on energy and sustainability to confront the impacts of a changing climate.



# Leading the Way to Energy Efficiency



# Leading the Way to Energy Efficiency





# Scope and Intent

## RESIDENTIAL ENERGY PROVISIONS

### *R101.2 Scope*

*This code applies to the design and construction of residential buildings.*

### *R101.3 Intent*

*The International Energy Conservation Code-Residential provides market-driven, enforceable requirements for the design and construction of residential buildings, providing minimum efficiency requirements for buildings that result in the maximum level of energy efficiency that is safe, technologically feasible, and life cycle cost effective, considering economic feasibility, including potential costs and savings for consumers and building owners, and return on investment. Additionally, the code provides jurisdictions with optional supplemental requirements, including requirements that lead to achievement of zero energy buildings, presently, and, through glidepaths that achieve zero energy buildings by 2030 and on additional timelines sought by governments, and achievement of additional policy goals as identified by the Energy and Carbon Advisory Council and approved by the Board of Directors. The code may include non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources developed by the Code Council and others. Requirements contained in the code will include, but not be limited to, prescriptive- and performance-based pathways. The code will aim to simplify code requirements to facilitate the code's use and compliance rate. The code is updated on a three-year cycle with each subsequent edition providing increased energy savings over the prior edition. The IECC residential provisions shall include an update to Chapter 11 of the International Residential Code. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this intent. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.*

# Cost Effectiveness



## Evaluating Cost Effectiveness

The working group recommends adoption of two simplified cost effectiveness methodologies allowing proponents flexibility when providing information.

- 1. Scalar Method** –The simple payback of a measure is compared to a pre-determined Scalar Ratio Threshold. This is the method used by ASHRAE 90.1. A measure is deemed cost effective when:

$$\frac{\textit{First Cost}}{\textit{Energy \& Maintenance Cost Savings}} < \textit{Scalar Ratio Threshold}$$

- 2. Net Present Value (NPV) Method** –First cost and annual electricity, fossil fuel and maintenance cost savings are multiplied by NPV Factors. If the NPV of the cost savings is greater than the NPV of the financed first cost than a measure is deemed cost effective.

$$\begin{aligned} &\textit{Fuel \$ Savings} * \textit{NPV Fuel Factor} \\ &+ \textit{Elec. \$ Savings} * \textit{NPV Elec. Factor} \\ &+ \textit{Maint. \$ Savings} * \textit{NPV Maint. Factor} \end{aligned} > \textit{First Cost} * \textit{NPV Cost Factor}$$



# Cost Effectiveness



## Example of how to use the recommended criteria

Consider a proposal with a service life of 15 years with a measure first cost of \$1000, and electricity savings of \$100 and fossil fuel savings of \$100.

Using criteria for 7% Real Discount Rate.

### Scalar Method

Simple payback = 5 (\$1000/\$200)

Weighted Scalar Threshold =  $11.7 * (\$100/\$200) + 10.9 * (\$100/\$200) = 11.3$

**Simple payback < Scalar threshold**      measure demonstrates cost effectiveness

### Net Present Value (NPV) Method

NPV Electricity Savings =  $\$100 * 8.11 = \$811$       and      NPV Fuel Savings =  $\$100 * 8.71 = \$871$ .

**NPV Savings = \$1056 + \$1142 = \$1,682**

**NPV First Cost = \$1000 \* 0.92 = \$920**

**NPV Savings > NPV Costs**

measure demonstrates cost effectiveness

# Cost Effectiveness

AutoSave On | cost-eff-calculator final (3) - Protected | Search | KStapher Stinger

File Home Insert Page Layout Formulas Data Review View Automate Developer Help Acrobat

PROTECTED VIEW Be careful—files from the Internet can contain viruses. Unless you need to edit, it's safer to stay in Protected View. Enable Editing

G21

**LCC Calculator - IECC Residential**

Enter values into blue boxes

**Proposal information**

Proposal number: REPI  
 CDP ID#  
 Proponent  
 Climate zone(s) analyzed: Enter specific climate zone or zones included in the analysis below  
 Additional notes

**Methodology**

Description of measure cost methodology  
 Description of savings calculation methodology. Include information about climate zones and fuel types where appropriate.

**Inputs**

Net measure cost: 2020\$, measure cost to consumer, including markup, less tax credits or other incentives.  
 Measure electric savings: 0 kWh/year  
 Measure natural gas savings: 0 therms/year  
 Measure propane savings: 0 gallons/year  
 If applicable:  
 Change in maintenance or other non-energy operating costs: 2020\$/year (+ for increased cost, - for decreased cost)  
 Replacement cost: 2020\$  
 Year of first replacement: For measures with life <30 years, # of years from date of construction  
 Year of second replacement: For measures with life <30 years, # of years from date of construction

**Results**

	Discount Rate			
	3.52% nominal DOE	7% real OMB	7% real OMB	
<b>With SOC value</b>				
Measure incremental LCC	\$0.00	\$0.00	\$0.00	2005 (+ for savings, - for costs)
Simple payback				Years
<b>With SOC = \$0</b>				
Measure incremental LCC	\$0.00	\$0.00	\$0.00	2005 (+ for savings, - for costs)
Simple payback				Years

Inputs&Results | Calculations

Ready | Display Settings | 40%

# 2024 Residential Code Development

Instead of code hearings, 2024 IECC was developed like a standard Residential Consensus Committee (48 members, selected in [early 2021](#))

- 15 Code Officials (ID, NJ, NY, MA, ME, TX, GA, NC, IA, FL, VA, LA, CO, MD)
- 10 Builders (NAHB, LBA, Habitat for Humanity, other homebuilders)
- 9 Public Segment (DOE, PNNL, NBI, EECC, SWEEP, MEEA, NRDC)
- 7 Users (Raters, Architects)
- 4 Manufacturers (AHRI, insulation, windows & doors, solar)
- 2 Utilities

Six Sub-Committees: Admin, Envelope, HVAC & HW, EPLR, & Modeling  
1<sup>st</sup> call for proposals were due in [October 2021](#)

# 2024 Residential Code Development

Over 200 proposals received; reviewed by sub-committees and Main by September 2022

~100 failed to attain consensus (i.e., two-thirds or 32 Yes votes)

~100 were approved as submitted, or more often, as modified

1<sup>st</sup> Public Comment draft posted online in October 2022

Over 400 proposals received; reviewed by sub-committees and Main by April 2023

2<sup>nd</sup> Public Comment draft will be posted online in May 2023

Over ## proposals received; reviewed by sub-committees and Main by September 2023

# Code Changes to expect in 2024 IECC-R

R401 General

**R401.2 Application.** Residential buildings shall comply with ~~Section R401.2.5 and~~ either Section R401.2.1, R401.2.2, R401.2.3 or R401.2.4.

~~**R401.2.5 Additional energy efficiency.** This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.~~

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

# Code Changes to expect in 2024 IECC-R

R402 Building Thermal Envelope

Flipped the rows and columns to match IECC-C format  
 Changes to fenestration and ceiling insulation U-factors

CLIMATE ZONE	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
FENESTRATION U-FACTOR <sup>fd</sup>	0.50	0.50	0.40	0.30	0.30	<del>0.30</del> 0.28 <sup>e</sup>	<del>0.30</del> 0.28 <sup>e</sup>	<del>0.30</del> 0.27 <sup>e</sup>
SKYLIGHT <sup>d</sup> U-FACTOR	<del>0.75</del> 0.60	<del>0.75</del> 0.60	<del>0.65</del> 0.60	<del>0.55</del> 0.53	<del>0.55</del> 0.53	<del>0.55</del> 0.50	<del>0.55</del> 0.50	<del>0.55</del> 0.50
GLAZED FENESTRATION SHGC <sup>d,e</sup>	0.25	0.25	0.25	0.25	0.40	<del>0.40</del> NR	NR	NR
CEILING U-FACTOR <sup>f</sup>	0.035	0.035	<del>0.026</del> 0.030	<del>0.026</del> 0.030	<del>0.024</del> 0.026	<del>0.024</del> 0.026	<del>0.024</del> 0.026	<del>0.024</del> 0.026

# Code Changes to expect in 2024 IECC-R

R402 Building Thermal Envelope

F-factors for slabs

CLIMATE ZONE	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
UNHEATED SLAB F- FACTOR <sup>9</sup>	0.73	0.73	0.73	0.54	0.51	0.51	0.48	0.48
HEATED SLAB F-FACTOR <sup>9</sup>	0.74	0.74	0.74	0.66	0.66	0.66	0.66	0.66

Total “UA” replaced with “TC”, where TC is UA + FP

What you won't see:

Changes to prescriptive wall U-factors

Anything related to embodied carbon or linear/point thermal bridges

# Code Changes to expect in 2024 IECC-R

## R402 Building Thermal Envelope

Air Leakage (Technical & Organizational changes)

Clarify the max allowed for each path & home type

Increased stringency:

R405 & R406: 5 ACH50 drops to **4.0 ACH50**

Prescriptive:

5 ACH50 drops to **4.0 ACH50** in **CZ 0-2**

3 ACH50 drops to **2.5 ACH50** in **CZ 6-8**

Multifamily:

Increased stringency: 0.30 cfm50/ft<sup>2</sup> drops to **0.27**

Add a **sampling** protocol for buildings with **8+** units

**Reduced** air leakage allowance if using **guarded** tests



# Code Changes to expect in 2024 IECC-R

## R403 Systems

R403.1.2 Heat Pump **Supplementary** Heat

New language to clarify the **controls** needed

Applies to **all** supplementary heat (electric resistance & other fuels)

# Code Changes to expect in 2024 IECC-R

## R403 Systems

### R403.3 Ducts

#### Technical, Editorial, and Organizational changes

- Revised and added definitions

- Created a table for max duct leakage values

- Provide **greater leakage** allowance where there are **more returns**

- Add test exemption for **ductless** systems (< 10 ft of ductwork)

- Add a **sampling** protocol for buildings with **8+** units

- Added **duct sizing** requirements (points to IRC and IMC)

# Code Changes to expect in 2024 IECC-R

R403 Systems (continued)

## R403.5.4 Hot Water Pipe Volume calculations

**TABLE R403.5.4**  
**INTERNAL VOLUME OF VARIOUS WATER DISTRIBUTION TUBING**

OUNCES OF WATER PER FOOT OF TUBE									
NOMINAL SIZE (inches)	COPPER TYPE M	COPPER TYPE L	COPPER TYPE K	CPVC CTS SDR 11	CPVC SCH 40	CPVC SCH 80	PE-RT SDR 9	COMPOSITE ASTM F1281	PEX CTS SDR 9
3/8	1.06	0.97	0.84	N/A	1.17	-	0.64	0.63	0.64
1/2	1.69	1.55	1.45	1.25	1.89	1.46	1.18	1.31	1.18
3/4	3.43	3.22	2.90	2.67	3.38	2.74	2.35	3.39	2.35
1	5.81	5.49	5.19	4.43	5.53	4.57	3.91	5.56	3.91
1 1/4	8.70	8.36	8.09	6.61	9.66	8.24	5.81	8.49	5.81
1 1/2	12.18	11.83	11.45	9.22	13.20	11.38	8.09	13.88	8.09
2	21.08	20.58	20.04	15.79	21.88	19.11	13.86	21.48	13.86

For SI: 1 foot = 304.8 mm, 1 inch = 25.4 mm, 1 liquid ounce = 0.030L, 1 oz/ft<sup>3</sup> = 305.15 g/m<sup>3</sup>.

N/A = Not available.

# Code Changes to expect in 2024 IECC-R

R403 Systems (continued)

R403.5.4 Hot Water **Pipe Volume** calculations

R403.5.5 **Demand Responsive** Water Heating

**What you won't see: demand responsive HVAC (only as a point in R408)**

R403.6.1 Heat or energy **recovery ventilation**

Expands requirement into **CZ 6**

# Code Changes to expect in 2024 IECC-R

R403 Systems (continued)

R403.5.4 Hot Water **Pipe Volume** calculations

R403.5.5 **Demand Responsive** Water Heating

**What you won't see: demand responsive HVAC (only as a point in R408)**

R403.6.1 Heat or energy **recovery ventilation**

**Expands requirement into CZ 6**

R403.7.1 Electric resistance space heating limits

**In CZ 4 to 8, 2 kW max unless at least ONE heat pump is installed**

**What you won't see: a prohibition on using gas / oil (see Appendix RE)**

# Code Changes to expect in 2024 IECC-R

R404 Electrical Power, Lighting, and Renewable Energy Systems

R404.1 to R404.3 [Lighting](#)

R404.4 Renewable energy certificate ([REC](#)) documentation

R404.5 [Electric Readiness](#)

Provide sufficient electric infrastructure where  
cooktop, oven, clothes dryer, or

non-electric  
water heater installed

[What you won't see:](#)

[Electric readiness requirement for space heating](#)

# Code Changes to expect in 2024 IECC-R

R404 Electrical Power, Lighting, and Renewable Energy Systems (cont'd)

## R404.6 Renewable Energy Infrastructure

Provide solar-ready zones (some Exceptions)

What you won't see:

Solar mandate (Appendix only)

Energy storage mandates (Appendix only)

# Code Changes to expect in 2024 IECC-R

R404 Electrical Power, Lighting, and Renewable Energy Systems (cont'd)

## R404.7 Electric Vehicle Power Transfer Infrastructure

EV-capable, EV-ready, or EV-installed (some Exceptions)

Single family (IRC):

One (1) space per unit

Group R-2:

40% of dwelling units or spaces, whichever is less



# Code Changes to expect in 2024 IECC-R

## R405 Simulated Building Performance

Clarifies that only **dwelling units** are modeled; **common areas** must instead meet prescriptive requirements in R402, R403, and R404.

Allows credit for **HVAC & DHW efficiency** and **duct location**

**85%** energy cost savings required for electric; **80%** for mixed-fuel homes

Homes larger than **5,000 ft<sup>2</sup>** have to perform **5%** better (**80** and **75%**)

Envelope backstop updated from **2009 IECC** to **1.08** or **1.15 X TC<sub>2024 IECC</sub>**

New site-to-source multipliers (**2.51** for electric, **1.09** for other fuels)

New **site** energy savings alternative to energy cost or source savings

Requires software to demonstrate compliance with **ASHRAE Std 140**

**What you won't see:** credit for lights, appliances, or renewables

# Code Changes to expect in 2024 IECC-R

## R406 Energy Rating Index Compliance

Clarifies that only **dwelling units** are modeled; **common areas** must instead meet prescriptive requirements in R402, R403, and R404.

Requires software tools to demonstrate compliance with **ASHRAE Std 140**

Removes the **ventilation rate** deviation

Updates to use ANSI 301-**2022** instead of 2019

Same **envelope backstop** as R405; no different if on-site power is present

No limit on how much on-site solar PV can contribute to code compliance

....but if you use OPP, your **ERI Max is much lower**

**Reduce the ERI Max by 1 point** compared to the 2021 IECC table values

For MF, allows the **average ERI** to be used to demonstrate compliance

# Code Changes to expect in 2024 IECC-R

**R406.5 ERI-based compliance.** Compliance based on an ERI analysis requires that the *rated design* and each confirmed as-built *dwelling unit* be shown to have an ERI less than or equal to the applicable value indicated in Table R406.5 where compared to the *ERI reference design* as follows:

1. Where on-site renewables are not installed, the maximum ENERGY RATING INDEX NOT INCLUDING OPP applies.
2. Where on-site renewables are installed, the maximum ENERGY RATING INDEX INCLUDING OPP applies.

### Exceptions:

1. Where the ERI analysis excludes OPP, the maximum ENERGY RATING INDEX NOT INCLUDING OPP shall be permitted.
2. For buildings with twenty or more *dwelling units*, where *approved* by the *code official*, compliance shall be permitted using the Average Dwelling Unit Energy Rating Index, as calculated in accordance with ANSI/RESNET/ICC 301.

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

# Code Changes to expect in 2024 IECC-R

R408 Additional Efficiency Requirements

Instead of 5 'packages', pick 2 'measures' that sum to 10 or more 'points'

Over 45 measures across 11 Measure Categories

1. Enhanced Building Envelope
2. More efficient Heating & Cooling
3. More efficient Hot Water
4. More efficient Duct Distribution
5. More efficient Ventilation
6. Energy Efficient Appliances
7. On-site renewables
8. Off-site renewables
9. Demand response HVAC
10. Opaque Walls
11. Whole home lighting control

# New (or updated) Appendices in 2024 IECC-R

Appendix RC – Zero **net** energy residential buildings (**updated**)

Appendix RD – Electric Energy Storage Provisions (**new!**)

Appendix RE – All-Electric residential buildings (**new!**)

Appendix RF – Alt. building thermal envelope insulation R-values (**new!**)

Appendix RP – On-Site Renewable Energy (**new!**)

Appendix RG – 2024 IECC Stretch Code (**new!**)

Appendix RH – Operational Carbon Rating and Energy Reporting (**new!**)

# PNNL Progress Indicator

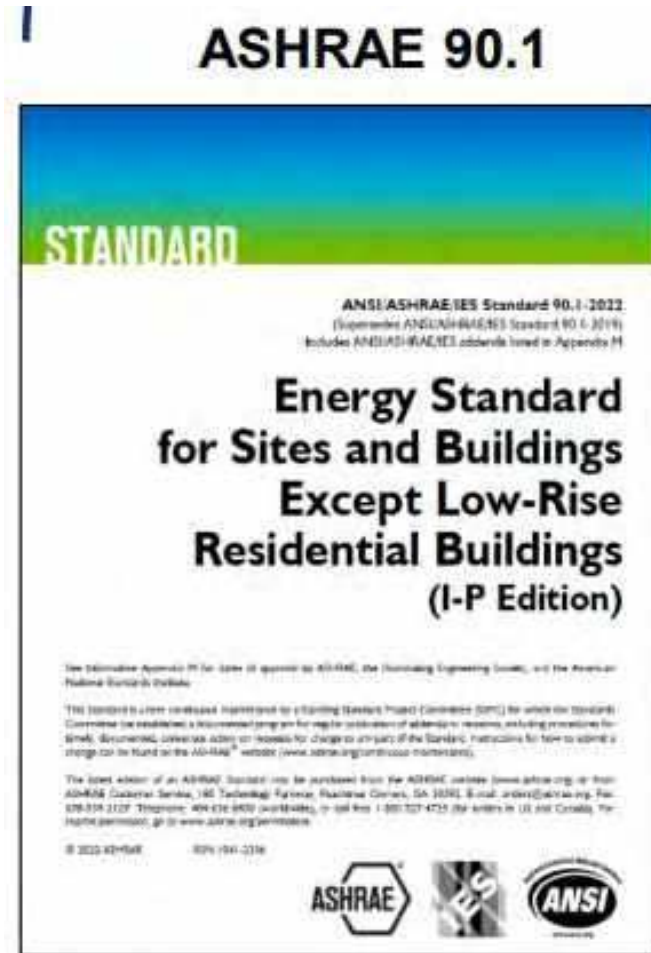


## Summary of Results

National Weighted Average		Site Energy [kBtu/ft <sup>2</sup> -yr] Energy Cost [\$ /residence-yr] Emissions [tons/kft <sup>2</sup> -yr]		% Savings
		IECC 2021	IECC 2024	
Whole Building	Site Energy	34	31.7	6.66%
	Energy Cost	2,009	1,881	6.41%
	Emissions	10.79	10.1	6.41%



# Commercial Building Energy Codes





# Commercial Building Energy Codes

The changes for the IECC are not finalized but it is likely that the following are some of the major changes will likely be included;

- **Additional efficiency credits** – Credits have been part of IECC codes for several cycles, but the 2024 will be expanded and somewhat align with the new credit option added to ASHRAE 90.1
- Addition of **Total System Performance Ratio (TSPR)**
- **Occupied standby controls** – Allow unoccupied rooms to change setpoint and ventilation during the occupied mode
- **Interior LPA reductions** – Reduction in lighting power levels
- **Egress lighting** off when unoccupied
- **Fan Energy Reductions** – Modification of fan power allowance to use a new watts/cfm and allowances for size of system resulting in a 10% reduction in fan energy. (Note this did not make ASHRAE 90.1-2022)
- **VAV turndown** requirements
- Parking garage ventilation
- 5% increase in renewable energy to **0.75 w/ft<sup>2</sup>** for the largest 3 floors
- Adoption of revised **HVAC efficiency tables** from ASHRAE 90.1 2022
- Other miscellaneous changes

# Commercial Building Energy Codes

Thermal bridging is the difference in thermal transmittance that occurs at the junction of different materials in a building envelope assembly. Mitigating thermal bridges that increase thermal transmittance is important to ensure the overall energy efficiency of building envelope.

**ASHRAE 90.1:** Robust thermal bridging requirements for certain linear thermal bridges: Parapets, balconies, cladding supports, vertical fenestration/wall intersections and intermediate floors that penetrate the wall plane.

**IECC 2024 Commercial:** Proposed a simplified version of 90.1 thermal bridging requirements

Representation of the increased thermal transmittance of an uninsulated slab that penetrates an insulated wall plane.

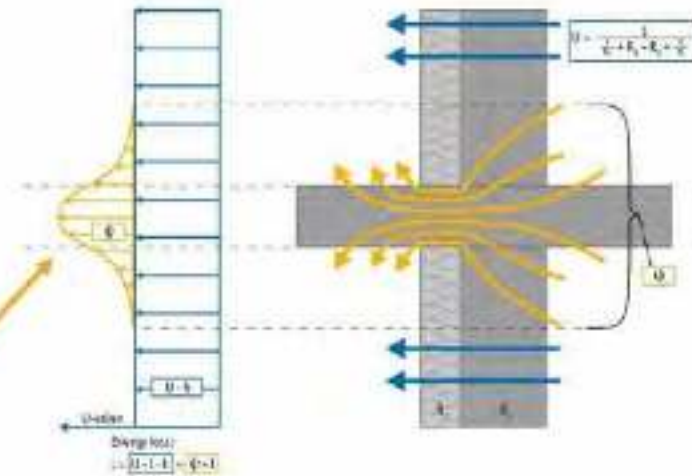
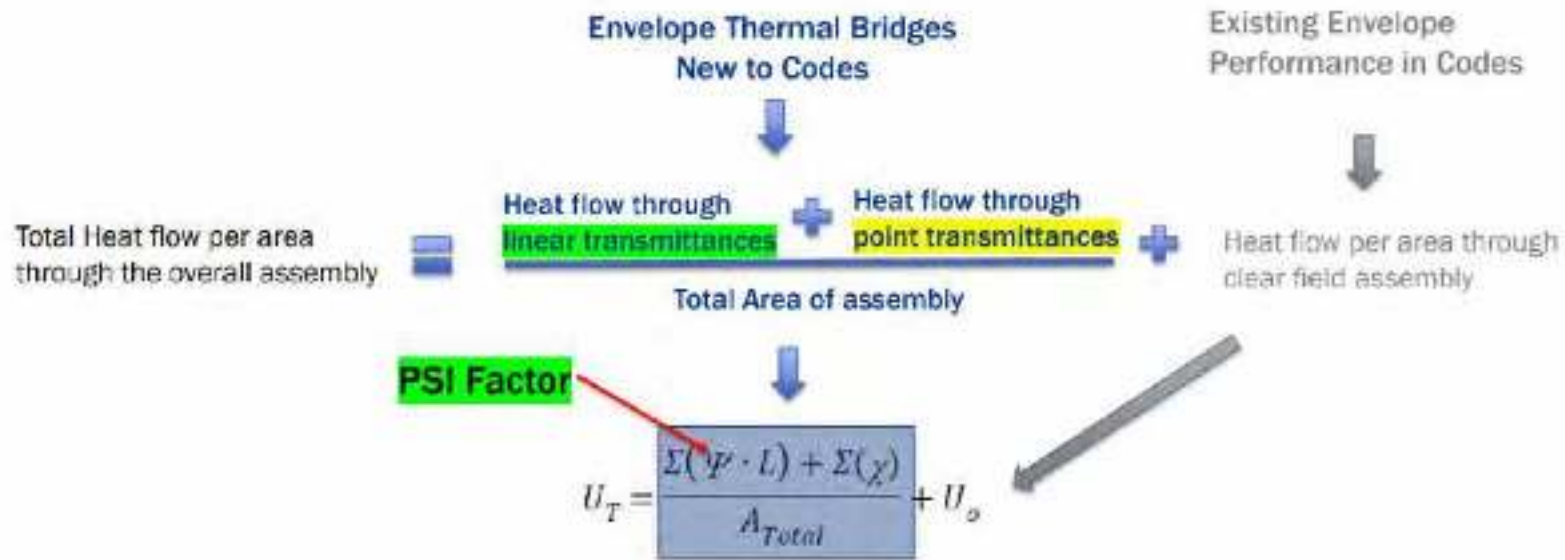


Image: Schöck USA, Inc.

# Commercial Building Energy Codes



$U_T$  = total effective assembly thermal transmittance (Btu/hrft<sup>2</sup>oF or W/m<sup>2</sup>K)

$U_o$  = clear field thermal transmittance (Btu/hrft<sup>2</sup>oF or W/m<sup>2</sup>K)

$A_{Total}$  = the total opaque wall area (ft<sup>2</sup> or m<sup>2</sup>)

**PSI Factor** =  $\psi$  = heat flow from linear thermal bridge (Btu/hrft oF or W/mK) -

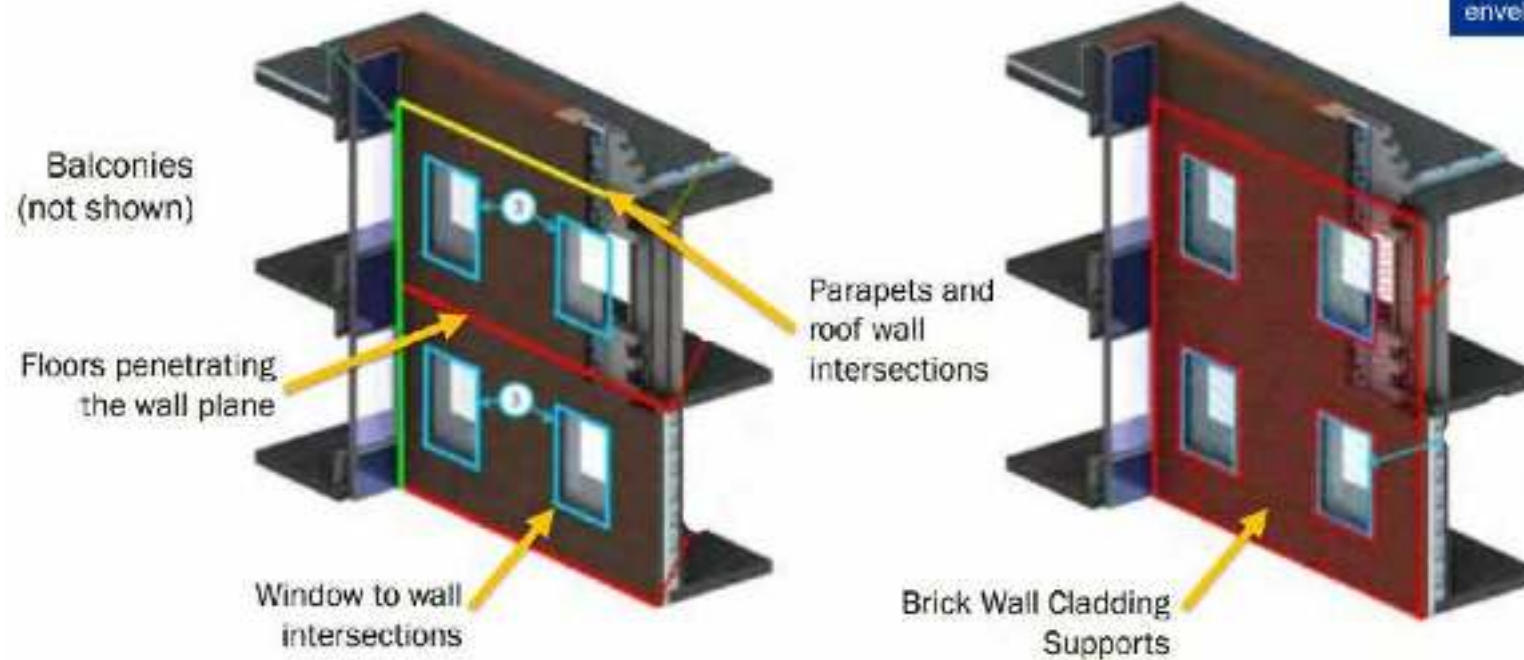
$L$  = length of linear thermal bridge, i.e. slab width (ft or m)

**CHI Factor** =  $\chi$  = heat flow from point thermal bridge (Btu/hr oF or W/K)

# Commercial Building Energy Codes

Provisions in ASHRAE 90.1 and proposed for IECC 2024 would prescribe minimum performance of the most common linear thermal bridges.

linear thermal bridge – horizontal, vertical or diagonal linear element that penetrates the insulation in the building envelope.





# Commercial Building Energy Codes

## IECC 2024 (proposed)

- Common set of mitigated and unmitigated Psi-factors for all above grade wall construction classes
- No requirements to account for point thermal bridges.
- Allows trade-offs using Component Performance Alternative or Total System Performance.

## ASHRAE 90.1

- Different mitigated and unmitigated Psi-factors for each above grade wall construction class (ie: wood, steel-frame).
- Requirement to account for certain point thermal bridges
- Option to use whole building performance rather than meeting prescriptive mitigated psi-factors or chi-factors.

		ASHRAE 90.1 (Final)				IECC 2024 (Proposed)	
		Unmitigated		Mitigated Default		Unmitigated	Mitigated Default
		Psi- Factor	Chi- Factor	Psi- Factor	Chi- Factor	Psi- Factor	Psi- Factor
Steel-frame	Roof edge	0.45		0.14			
	Parapet	0.289		0.151		0.4	0.2
	Intermediate floor to wall intersection	0.487		0.177		0.5	0.2
	Intermediate floor balcony or overhang to opaque wall intersection	0.487		0.177		0.5	0.2
	Intermediate floor balcony in contact with Vertical Fenestration	0.974		0.177		0.5	0.2
	Cladding Support	0.314		0.217		0.3	0.2
	Wall to Vertical Fenestration intersection	0.262		0.112		0.3	0.15
	Other Element and Assembly Intersections		1.73		0.91		

# Commercial Building Energy Codes

**Basic Idea:** Set HVAC system performance requirement and allow equivalent HVAC system tradeoffs by comparing a buildings proposed TSPR to a target TSPR.

Currently TSPR has been adopted into:

**ASHRAE 90.1 -2022 (optional)**

**State of Washington Energy Code (mandatory)**

And is being considered as an optional compliance path in:

**IECC 2024 Commercial and NY Stretch 2023.**

## Why HVAC Performance (TSPR)?

- A particular building may have trouble with a prescriptive requirement like fan power limits or economizers
- Allows trade off within HVAC system, get credit for higher equipment efficiencies, reduced pump power or more DCV.
- Results in equivalent energy input for a "good" system selection
- Reduces complexity compared to a whole building analysis
- Can drive HVAC performance with out violating EPACT rules

**HVAC Performance Metric:**

$$\text{TSPR} = \frac{\text{Heating} + \text{Cooling Loads Delivered}}{\text{Annual HVAC Operating Input}^*}$$



**TSPR is the HVAC system performance for the whole building HVAC system**

# Commercial Building Energy Codes

## Alignment with Appendix G Modeling Process

Compliance achieved when:

$$TSPR_{\text{proposed}} \text{ must be } \geq TSPR_{\text{reference}} / \text{MPF}$$

- **Proposed System** – Your Building HVAC System
- **Reference System** – Aligned with Appendix G (ca. 2004)
- **Target System** – Aligned with prescriptive, but not worst option
- **MPF** – Mechanical Performance Factor

$$\text{MPF} = \frac{TSPR \text{ reference}}{TSPR \text{ target}}$$

Building Area Type	Climate Zone		
	0A and 1A	0B and 1B	2A
Multifamily	0.68	0.70	0.66
Healthcare <sup>1</sup>	0.60	0.60	0.58

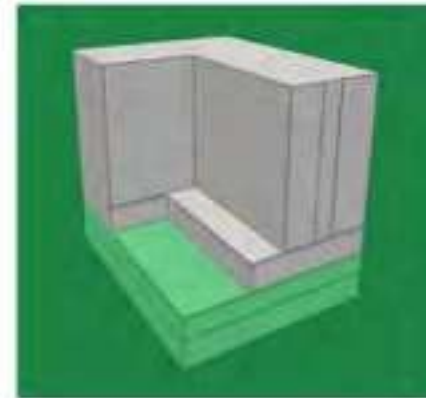
# Commercial Building Energy Codes

## Compliance Calculation Tool

- ▶ Based on code language that describes the ruleset
- ▶ New tool provided by DOE (free)
- ▶ Simplified tool for assessing building energy efficiency
  - Not a prototype approach, based on actual simplified building
- ▶ Uses default ASHRAE 90.1 Appendix C loads and schedules
- ▶ Lighting, equipment and envelope loads same as reference



Detailed Energy Model



Block Based Simplified Model



# Commercial Building Energy Codes

32 Energy Credit Measures  
Requirements achieve 7% building  
energy cost savings

Each credit represents 1/10%  
whole building site energy

Measure points requirements  
selected to be cost effective

Allow portion of energy credit to  
be met with load management  
and renewable credits

Graphic credit PNNL

**Energy Credit Measures**

**Efficiency Measures**

- Envelope performance
- UA reduction (15%)\*
- Envelope leak reduction\*
- Add roof insulation\*
- Add wall insulation\*
- Improve fenestration\*

**HVAC Measures**

- HVAC performance
- Heating efficiency
- Cooling efficiency
- Residential HVAC control
- Ground source heat pump\*
- DOAS/fan control

**Water Heating Measures**

- SHW preheat recovery
- Heat pump water heater
- Efficient gas water heater
- SHW pipe insulation
- Point of use water heaters
- Thermostatic bal. valves
- SHW heat trace system\*
- SHW submeters
- SHW flow reduction
- Shower heat recovery

**Lighting Measures**

- Lighting dimming & tuning
- More occupancy sensors
- Increase daylight area
- Residential light control
- Light power reduction

**Power & Equipment Measures**

- Energy monitoring
- Efficient elevator
- Efficient commercial kitchen equipment
- Residential kitchen equipment
- Fault detection
- Guideline 36 controls\*\*

**Renewable & Load Management Measures**

- Renewable energy
- Lighting load management
- HVAC load management
- Automated shading
- Electric energy storage
- Cooling energy storage
- SHW energy storage
- Building mass/night flush



\*Only in IECC;  
\*\*Only in Standard 90.1