

# 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

### 0100.1 Information on construction documents.

Construction documents shall be drawn to scale upon which accurate (existing shall show permanent and shall reflect) construction measures (qualitative or quantitative) are indicated (existing) and shall include total gross floor area and features of the building systems (mechanical and electrical) to be installed or replaced as required.

1. Insulation location and R-value.
2. Thermal and air leakage control (air seal, weatherstripping).
3. Air-conditioning systems (include design conditions, equipment).
4. Mechanical systems design criteria.
5. Mechanical and electrical load-carrying system and equipment (size, location, etc.).
6. Electrical distribution.
7. Equipment and system control.
8. Fan motor horsepower (include motor).
9. Duct sealing (air and gas leakage resistance).
10. Lighting fixture schedule (include voltage and wattage).
11. Ventilation equipment (include flow rate).
12. Air conditioning.

### 0100.2 Building thermal envelope (Appendix).

Building thermal envelope shall be constructed to meet the minimum energy...

## 2023 FBC Energy Conservation

### 0100.1 Information on construction documents.

Construction documents shall be drawn to scale upon which accurate (existing shall show permanent and shall reflect) construction measures (qualitative or quantitative) are indicated (existing) and shall include total gross floor area and features of the building, systems and equipment to be installed or replaced as required based on the following, as applicable:

1. Energy compliance path.
2. Insulation location, R-value.
3. Thermal and air leakage control (air seal, weatherstripping).
4. Air-conditioning systems and equipment (include design conditions, equipment).
5. Mechanical systems design criteria.
6. Mechanical and electrical load-carrying system and equipment (size, location, etc.).
7. Electrical distribution.
8. Equipment and system control.
9. Fan motor horsepower (include motor).
10. Duct sealing (air and gas leakage resistance).
11. Lighting fixture schedule (include voltage and wattage).
12. Ventilation equipment (include flow rate).
13. Air conditioning.

### 0100.2 Building thermal envelope (Appendix).

Building thermal envelope shall be constructed to meet the minimum energy...



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

- 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>a</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
<b>Roofs</b>																
Mass <sup>b</sup>	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-12.5ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
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 <sup>f</sup>	R-30 <sup>f</sup>	R-30 <sup>f</sup>	R-30 <sup>f</sup>	R-30 <sup>f</sup>
<b>Slab-on-grade floors</b>																

## 2020 FBC Energy Conservation

Mass <sup>b</sup>	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-12.5ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
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>
<b>Slab-on-grade floors</b>																
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>f</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 C-402.3 MINIMUM ROOF REFLECTANCE AND EMITTANCE OPTIONS<sup>1</sup>**

Three-year aged solar reflectance <sup>2</sup> of 0.25 (0.45 for Climate Zone 1A) and 3-year aged thermal emittance <sup>3</sup> of 0.75
Three-year aged solar reflectance index <sup>4</sup> of 84 (75 for Climate Zone 1A)

1. The use of photovoltaic technology complies with local requirements and/or permits. Materials using 3-year aged solar reflectance values shall be based on a 3-year aged solar reflectance index determined in accordance with [ASCE 2019-1](#) and a 3-year aged thermal emittance of 0.75.
2. Aged solar reflectance index is determined per ASTM E 1914-20, ASTM E 1918-19, or ASTM E 1918-19.
3. Aged thermal emittance index is determined per ASTM E 1914-20, ASTM E 1918-19, or ASTM E 1918-19.
4. Solar reflectance index (SRI) shall be determined in accordance with [ASTM E 1914-20](#) using a conversion coefficient of 1.004.  $SRI = 100 \times (R - 0.09)$ . 5. Calculation of aged SRI shall be based on aged solar values of solar reflectance and thermal emittance.

## 2020 FBC Energy Conservation

**TABLE C-402.3 MINIMUM ROOF REFLECTANCE AND EMITTANCE OPTIONS<sup>1</sup>**

Three-year aged solar reflectance <sup>2</sup> of 0.25 and 3-year aged thermal emittance <sup>3</sup> of 0.75
Three-year aged solar reflectance index <sup>4</sup> of 75

1. The use of photovoltaic technology complies with local requirements and/or permits. Materials using 3-year aged solar reflectance values shall be based on a 3-year aged solar reflectance index determined in accordance with [ASCE 2019-1](#) and a 3-year aged thermal emittance of 0.75.
2. Aged solar reflectance index is determined per ASTM E 1914-20, ASTM E 1918-19, or ASTM E 1918-19.
3. Aged thermal emittance index is determined per ASTM E 1914-20, ASTM E 1918-19, or ASTM E 1918-19.
4. Solar reflectance index (SRI) shall be determined in accordance with [ASTM E 1914-20](#) using a conversion coefficient of 1.004.  $SRI = 100 \times (R - 0.09)$ . 5. Calculation of aged SRI shall be based on aged solar values of solar reflectance and thermal emittance.

# 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>	SEW	N	SEW	N
PF < 0.2	0.25	0.33	0.25	0.33
0.2 ≤ PF < 0.5	0.30	0.37	0.30	0.37
PF ≥ 0.5	0.40	0.40	0.40	0.40
<b>U-factor</b>			0.75	0.65
<b>SHGC</b>			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>	SEW	N	SEW	N
PF < 0.2	0.25	0.33	0.25	0.33
0.2 ≤ PF < 0.5	0.30	0.37	0.30	0.37
PF ≥ 0.5	0.40	0.40	0.40	0.40
<b>U-factor</b>			0.75	0.65
<b>SHGC</b>			0.35	0.35

2021 IECC

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>	SEW	N	SEW	N
PF < 0.2	0.25	0.33	0.25	0.33
0.2 ≤ PF < 0.5	0.30	0.37	0.30	0.37
PF ≥ 0.5	0.40	0.40	0.40	0.40
<b>U-factor</b>			0.75	0.65
<b>SHGC</b>			0.35	0.35

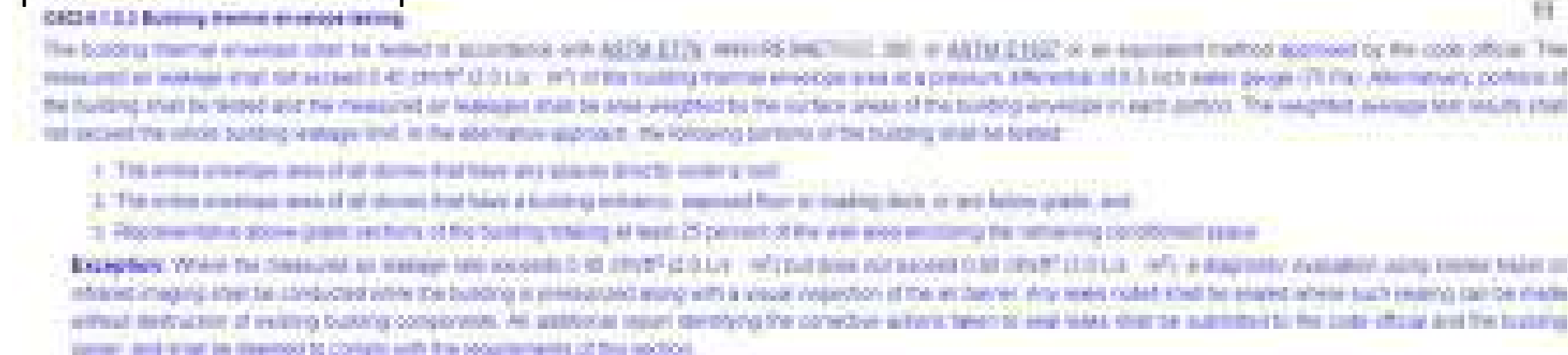
# Significant changes from the 2020 FBC Energy Conservation Code to the 2023 FBC (8<sup>th</sup> Edition)

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

## 2023 FBC Energy Conservation



- 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.





# 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

### C402.1 Air leakage—thermal envelope (Mandatory).

The thermal envelope of buildings shall comply with [Sections C402.0.1 through C402.5.0](#), or the building thermal envelope shall be tested in accordance with ASTM E770 at a pressure differential of 0.3 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  $\text{cm}^3/\text{s} \cdot \text{m}^2$  (0.1  $\text{L}/\text{s} \cdot \text{m}^2$ ). Where compliance is based on such testing, the building shall also comply with [Sections C402.5.1](#), [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 exterior portion of the box shall be caulked. Where present, insulation shall rest against an insulated portion of the box.

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

Where air-sealed boxes are installed, they shall be installed in accordance with NFPA 70-8. 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

### C403.6.11 Operable openings (mandatory) (Minimum)

Where occupancies utilize operable openings in the building 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 heating setpoint to 30 degrees and lower the cooling setpoint to 30 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 HVAC loads of a restaurant or similar type of occupancy.
2. Warehouses that utilize overhead doors for the function of the occupancy, where approved by the code official.
3. The first entrance doors where located in the exterior wall and are part of a vestibule system.

### C403.2.11.1 Operable controls (Mandatory)

Controls shall comply with Section C403.6.

### C403.2.12.4 Large-diameter ceiling fans

Where provided, large-diameter ceiling fans shall be tested and labeled in accordance with ASHRAE 129 and shall meet the efficiency requirements of Table C403.2.12.5 and Section C403.2.12.6.1.

TABLE C403.2.12.5 CEILING FAN EFFICIENCY REQUIREMENTS<sup>a</sup>

EQUIPMENT TYPE	MINIMUM EFFICIENCY <sup>b, c</sup>	TEST PROCEDURE
Large-diameter ceiling fan for destinations outside the US <sup>d</sup>	CPEF ≥ 1.08 at high maximum speed CPEF ≥ 1.31 at 40% of high speed or fan lowest speed that is not less than 40% of high speed	ISO-CFM 100-Nominate I or AMCA Standard 739 and AMCA Standard 208 (for T1 requirements)

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.



# 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.



# 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

This is a blurred screenshot of a table from the 2020 FBC Energy Conservation code. The table is titled "Interior Lighting Power Allowance" and is organized into columns for "Building Area Method" and "Space by Space Method". The rows list various building types and their corresponding power allowances in Watts per square foot (W/sq ft).

2023 FBC Energy Conservation

This is a blurred screenshot of a table from the 2023 FBC Energy Conservation code. The table is titled "Interior Lighting Power Allowance" and is organized into columns for "Building Area Method" and "Space by Space Method". The rows list various building types and their corresponding power allowances in Watts per square foot (W/sq ft).

# 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 20,000 FT <sup>2</sup>	EXHIBIT CENTER 100,000 FT <sup>2</sup>
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FIG. 2.1 (continued) - 2020 FBC

Commentary Figure C405.3.2(1) MULTISE FACILITY

SPACE CATEGORY	GROSS CONDITIONED FLOOR AREA (SQUARE FEET)	SPACE CATEGORY	LIGHTING POWER DENSITY (WATT PER SQUARE FOOT)	LIGHTING POWER ALLOWANCE (WATT PER SQUARE FOOT)
Office	500,000	A	0.75	120,000
Post office	100,000	B	0.75	75,000
Department store—sales and dressing areas	20,000	B	0.88	17,600
Department store—sales floor	20,000	A	0.40	8,000
Exhibit center	100,000	B	0.75	75,000
<b>Total for building</b>	<b>740,000</b>	<b>B</b>	<b>—</b>	<b>307,200</b>

FIG. 2.1 (continued) - 2020 FBC. 1. exhibit center not in 2020 FBC

Commentary Figure C405.3.2(2)

TOTAL LIGHTING POWER ALLOWANCE CALCULATION USING THE BUILDING AREA METHOD

SPACE CATEGORY	GROSS CONDITIONED FLOOR AREA (SQUARE FEET)	SPACE CATEGORY	LIGHTING POWER DENSITY (WATT PER SQUARE FOOT)	LIGHTING POWER ALLOWANCE (WATT PER SQUARE FOOT)
Office—warehouse	100,000	B	0.74	74,000
Office—open plan	400,000	B	0.74	296,000
Post office	100,000	B	0.75	75,000
Retail—sales area	20,000	B	1.08	21,600
Retail—warehouse	20,000	A	0.40	8,000
Retail—dressing area	1,000	B	0.75	750
Exhibit center—sales	100,000	B	0.75	75,000
<b>Total for building</b>	<b>740,000</b>	<b>—</b>	<b>—</b>	<b>592,300</b>

FIG. 2.1 (continued) - 2020 FBC. 1. exhibit center not in 2020 FBC

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



## 2021 IECC

TABLE C407.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

SECTION*	TITLE
	<b>Envelope</b>
C402.1	Air leakage—thermal envelope
	<b>Mechanical</b>
C402.1.1	Calculation of heating and cooling loads
C402.1.2	Duct systems
C402.2	System design
C402.3	Heating and cooling equipment efficiency
C402.3.1 and C402.3.2, C402.3.3 and C402.3.4	Heating and cooling system controls
C402.4	Minimum load duration 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

### R160.2 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 inform proposed, and show in sufficient detail pertinent data and features of the building systems that 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 coefficients (SHGC).
3. Area-weighted U-factor and solar heat gain coefficients (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water-heating system and equipment types, sizes and efficiencies.
6. Equipment and system controls.
7. Duct sealing, duct and pipe insulation and location.
8. Air sealing details.

### R160.2.1 Building thermal envelope depiction.

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

## 2023 FBC Energy Conservation

### R160.2 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 the load proposed, and show in sufficient detail pertinent data and features of the building systems and shall include, but are not limited to, the following as applicable:

1. Energy compliance path.
2. Insulation materials and their R-values.
3. Fenestration U-factor and solar heat gain coefficients (SHGC).
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.

### R160.2.1 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, i</sup>	SKYLIGHT <sup>b</sup> U-FACTOR	GLAZED FENESTRATION SHGC <sup>b, e</sup>	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE <sup>l</sup>	FLOOR R-VALUE	BASEMENT <sup>c</sup> WALL R-VALUE	SLAB <sup>d</sup> R-VALUE & DEPTH	CRAWL SPACE <sup>c</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	38	13	4/6	13	0	0	0
3	0.35	0.55	0.25	38	20 or 13+5 <sup>h</sup>	8/13	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, i</sup>	SKYLIGHT <sup>b</sup> U-FACTOR	GLAZED FENESTRATION SHGC <sup>b, e</sup>	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE <sup>l</sup>	FLOOR R-VALUE	BASEMENT <sup>c</sup> WALL R-VALUE	SLAB <sup>d</sup> R-VALUE & DEPTH	CRAWL SPACE <sup>c</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	38	13	4/6	13	0	0	0
3	0.35	0.55	0.25	38	20 or 13+5 <sup>h</sup>	8/13	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

### 602.4.1.1 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 90.1-2019](#) and reported at a pressure of 0.2 inch w.g. (50 Pascals). Testing shall be conducted by either individuals as defined in Section 602.4.1.1(1) or (2), [Florida Statute](#), or individuals licensed as per both in Section 488.105(3)(f), (g) or (h) 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 completion of all penetrations of the building thermal envelope.

## 2020 FBC Energy Conservation

### 602.4.1.1 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 90.1-2019](#) and reported at a pressure of 0.2 inch w.g. (50 Pascals). Testing shall be conducted by either individuals as defined in Section 602.4.1.1(1) or (2), [Florida Statute](#), or individuals licensed as per both in Section 488.105(3)(f), (g) or (h) 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 completion 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	58
2	58
3	51
4	54
-	--

## 2020 FBC Energy Conservation

TABLE R406.4 MAXIMUM ENERGY RATING INDEX



CLIMATE ZONE	ENERGY RATING INDEX
1	58
2	58
3	51
4	54

# 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



# 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

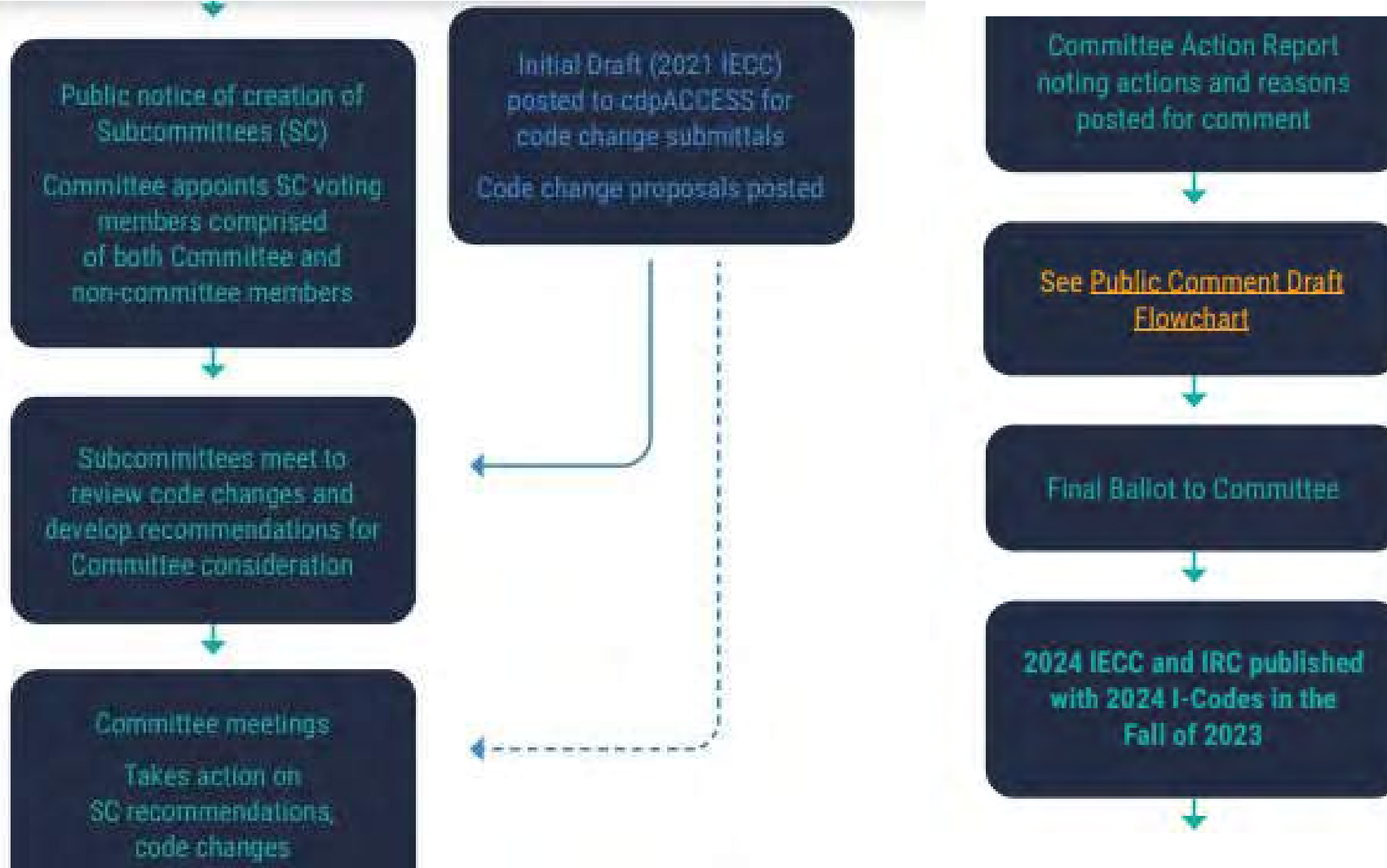
- [iccsafe.org/energy](http://iccsafe.org/energy)



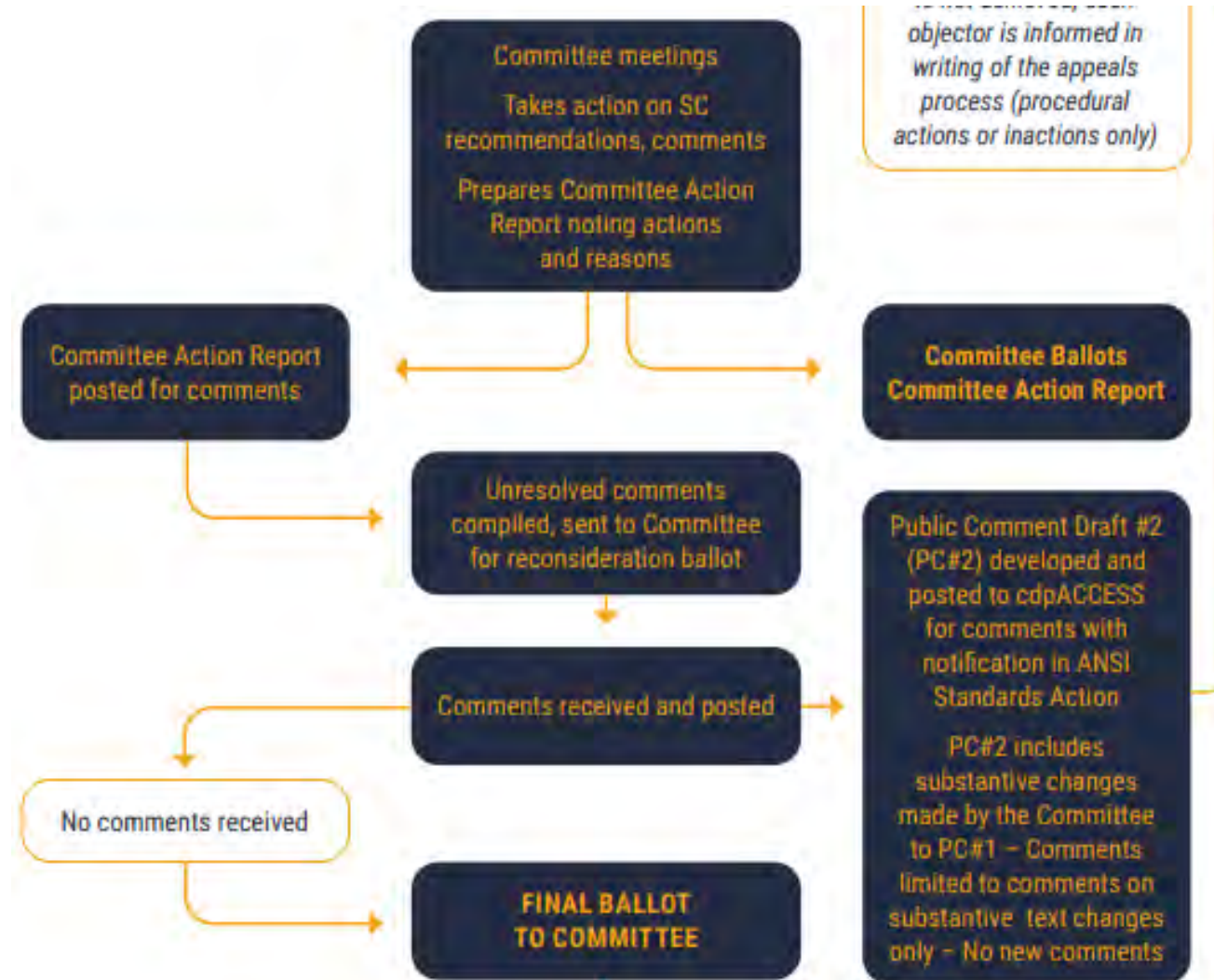
The International Code Council family of solutions is helping our communities forge a path forward on energy and sustainability to confront the impacts of a changing climate.



# 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 guidance that achieve zero energy buildings by 2020 and on additional timelines as 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 abrogate 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:

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

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 then a measure is deemed cost effective.

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



# 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 =  $\$100 * 0.11 = \$811$       and      NPV Fuel Savings =  $\$100 * 0.71 = \$871$

NPV Savings =  $\$1000 + \$1142 = \$1,682$

NPV First Cost =  $\$1000 * 0.82 = \$820$

**NPV Savings > NPV Costs**

measure demonstrates cost effectiveness

# Cost Effectiveness

The screenshot displays a Microsoft Excel spreadsheet with a green header bar and a yellow title bar. The main content area is divided into two columns. The left column contains a list of categories with corresponding data cells, some of which are highlighted in blue. The right column contains a table with numerical data, also with some yellow highlighting. The spreadsheet is viewed in a window titled "Microsoft Excel - [Workbook Name]". The status bar at the bottom shows "Page: 1 of 1" and "Page Count: 1".

Category	Value	Value	Value	Value
Category 1				
Category 2				
Category 3				
Category 4				
Category 5				
Category 6				
Category 7				
Category 8				
Category 9				
Category 10				
Category 11				
Category 12				
Category 13				
Category 14				
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Category 40				
Category 41				
Category 42				
Category 43				
Category 44				
Category 45				
Category 46				
Category 47				
Category 48				
Category 49				
Category 50				

# 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>g</sup>	0.73	0.73	0.73	0.54	0.51	0.51	0.48	0.48
HEATED SLAB F-FACTOR <sup>g</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>2</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

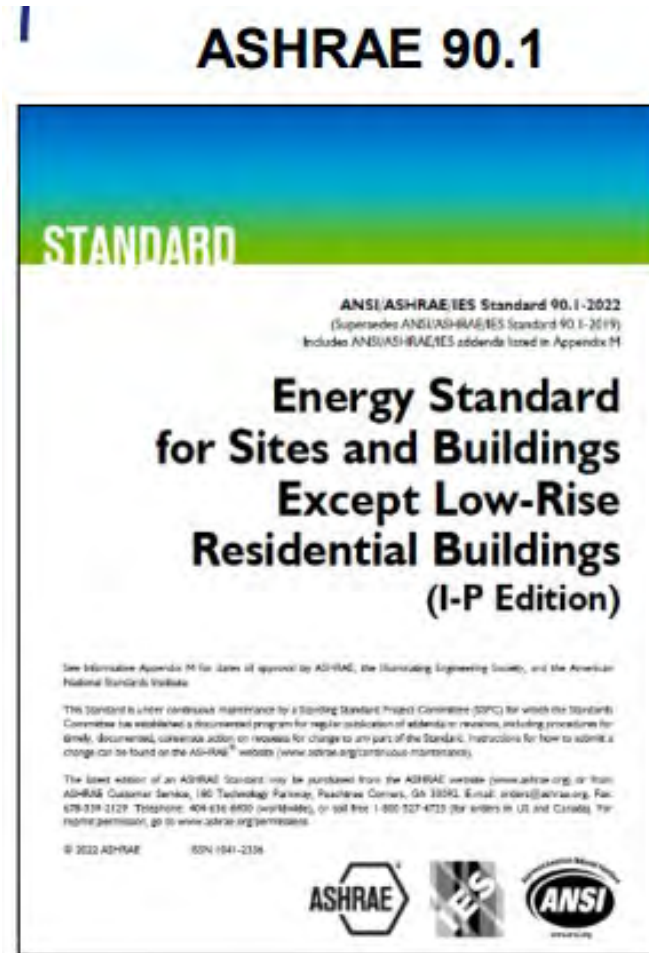


## Summary of Results

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 wft<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/web 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.

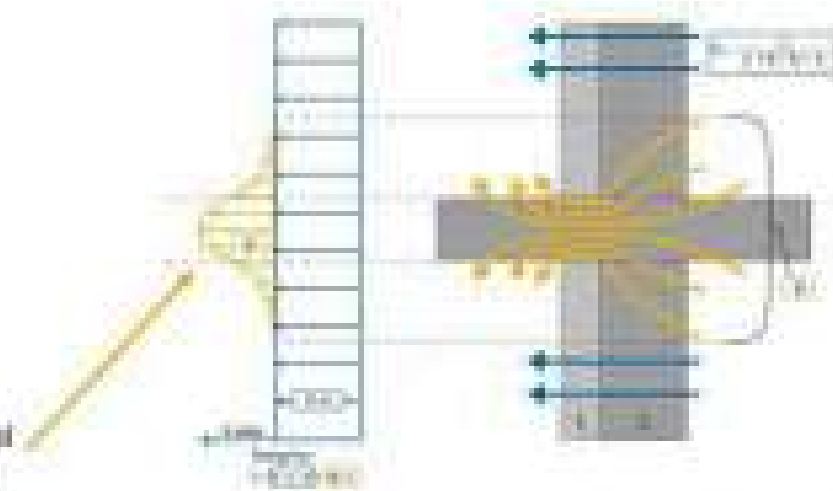
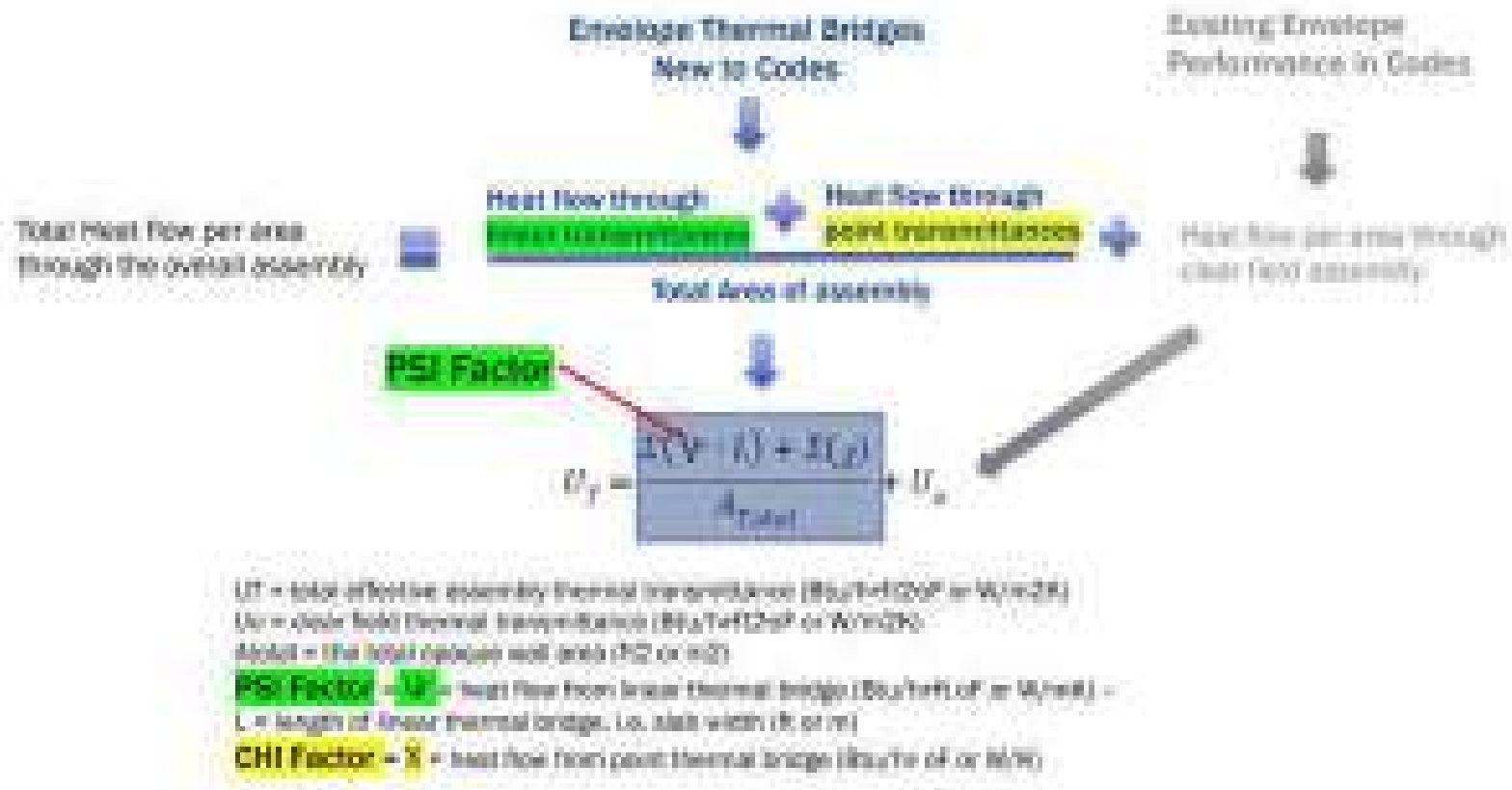


Image courtesy of ASHRAE, Inc.

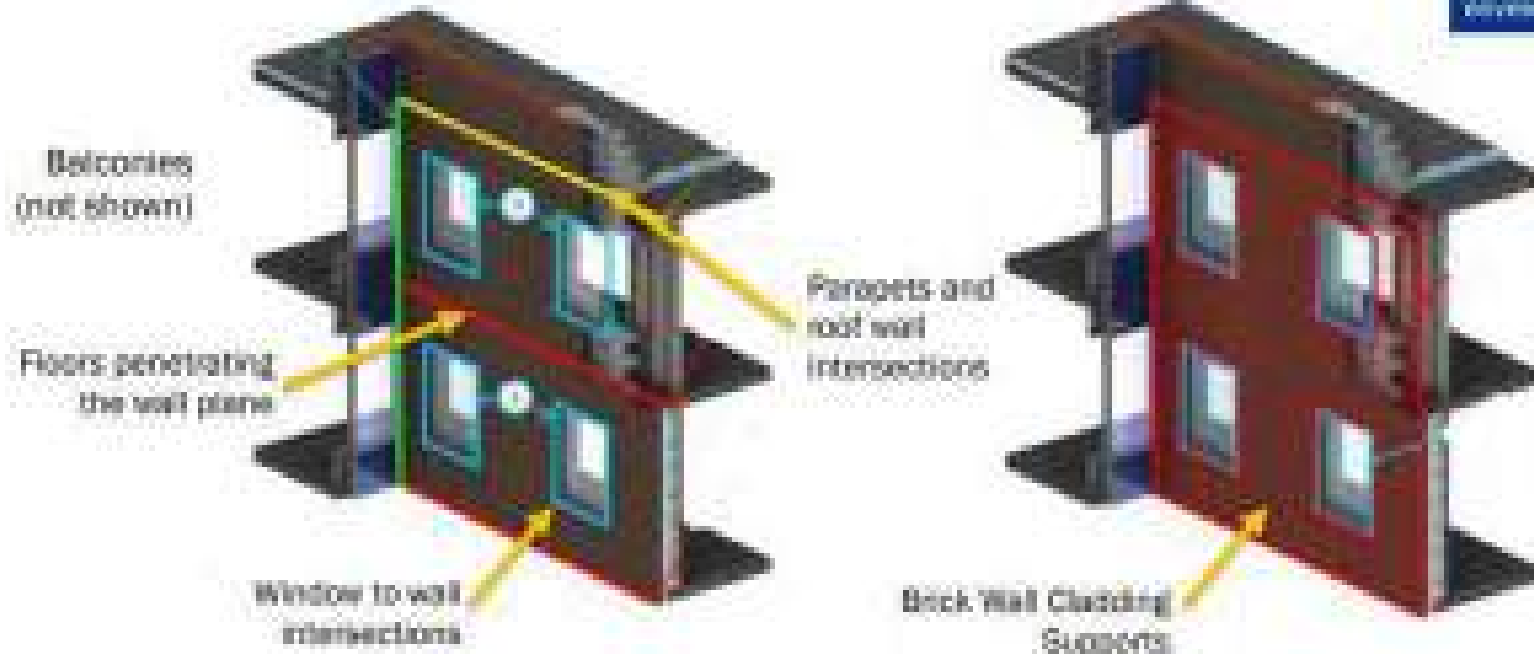
# Commercial Building Energy Codes



# 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 brack 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 (e.g. 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	0.3	
	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	0.934		0.177	0.5	0.2	
	Cladding support	0.314		0.317	0.3	0.2	
	Wall to Vertical Fenestration Intersection	0.262		0.312	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.**

**HVAC Performance Metric:**

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

## 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 without violating EFACT rules



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

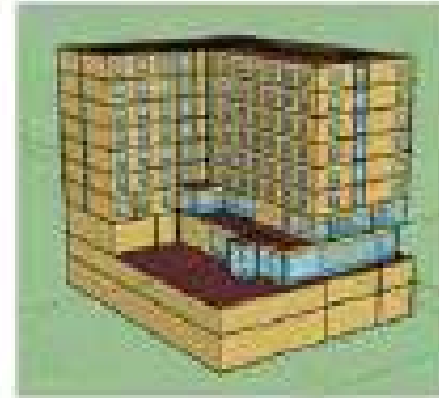
$$\text{MPF} = \frac{TSPR_{\text{reference}}}{TSPR_{\text{target}}}$$

Building Area Type	Climate Zone		
	04 and 1A	05 and 1B	06
Multifamily	0.55	0.70	0.55
Healthcare	0.60	0.60	0.58

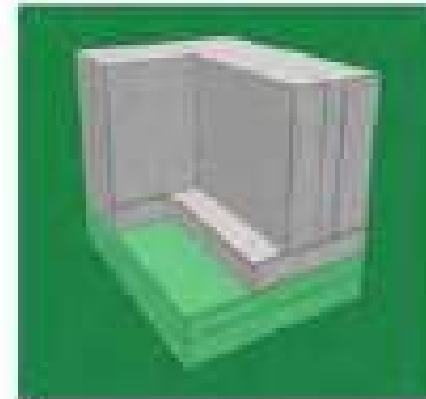
# Commercial Building Energy Codes

## 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 (HSNY)
  - + 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**
  - + DHW preheat recovery
  - + Heat pump water heater
  - + Efficient gas water heater
  - + DHW pipe insulation
  - + Point of use water heaters
  - + Thermostatic hot water valves
  - + DHW heat trace system\*
  - + DHW submersibles
  - + DHW flow reduction
  - + DHW heat recovery
- Lighting Measures**
  - + Lighting dimming & zoning
  - + More occupancy sensors
  - + Increase daylight area
  - + Residential light control
  - + Light power reduction
- Power & Equipment Measures**
  - + Energy monitoring
  - + CFL use wherever
  - + CFL use commercial kitchen equipment
  - + Residential kitchen equipment
  - + Fault detection
  - + On-Off 30 controls\*\*
- Renewable & Load Management Measures**
  - + Renewable energy
  - + Lighting load management†
  - + HVAC load management
  - + Automated shading
  - + Electric energy storage
  - + Cooling energy storage
  - + DHW energy storage
  - + Building mass night flush

\*Only in AECG  
\*\*Only in Standard 90.1