

# **Significant Changes in the 2021 IECC and Its Impact on Design and Construction of Buildings**

**September 14, 2021**

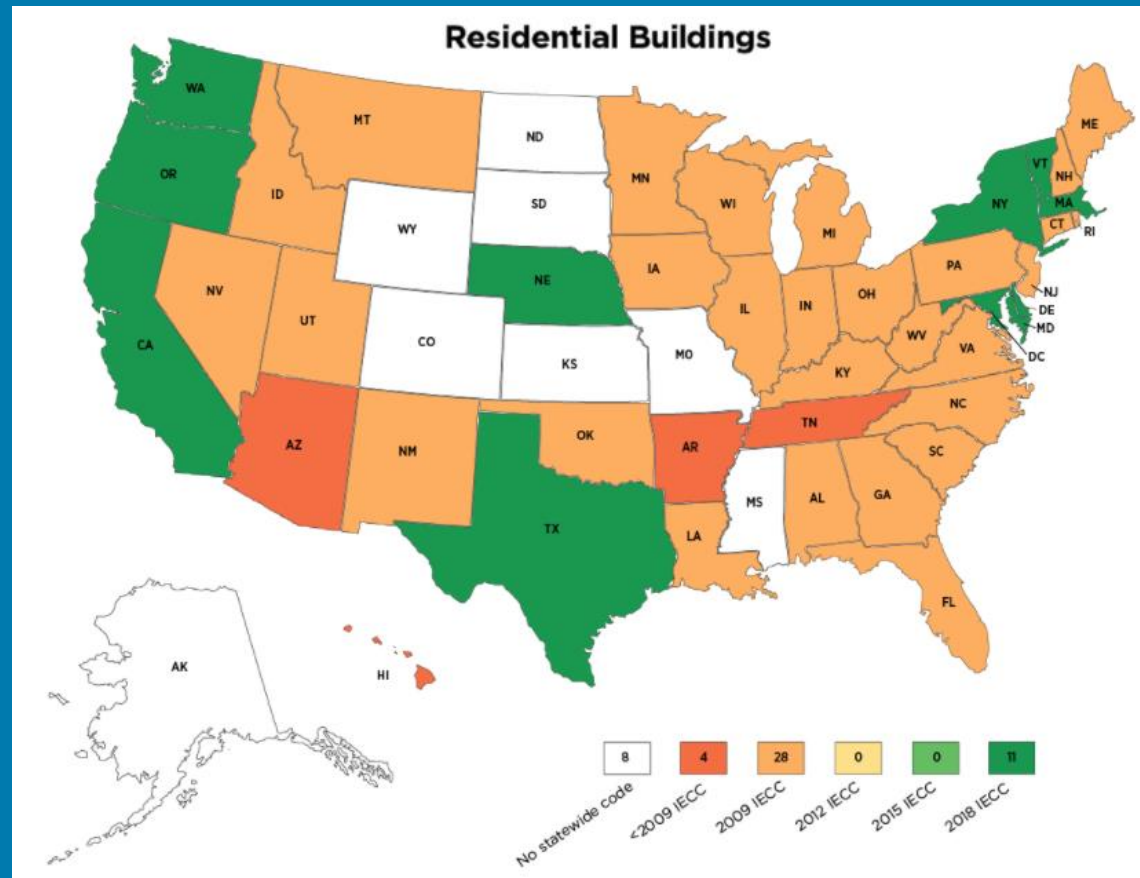
**Eric Lacey**

**RECA Chairman**

**© Responsible Energy Codes Alliance**

# Fast Facts about IECC

- Result of multi-year consensus-based process that involves the nation's code officials and building code experts.
- Adopted by the vast majority of U.S. States.
- The most widely-adopted and successful energy code in the country.
- Important tool for policymakers interested in reducing waste, building resiliency, and minimizing environmental impact of buildings.



Map from [www.energycodes.gov](http://www.energycodes.gov)

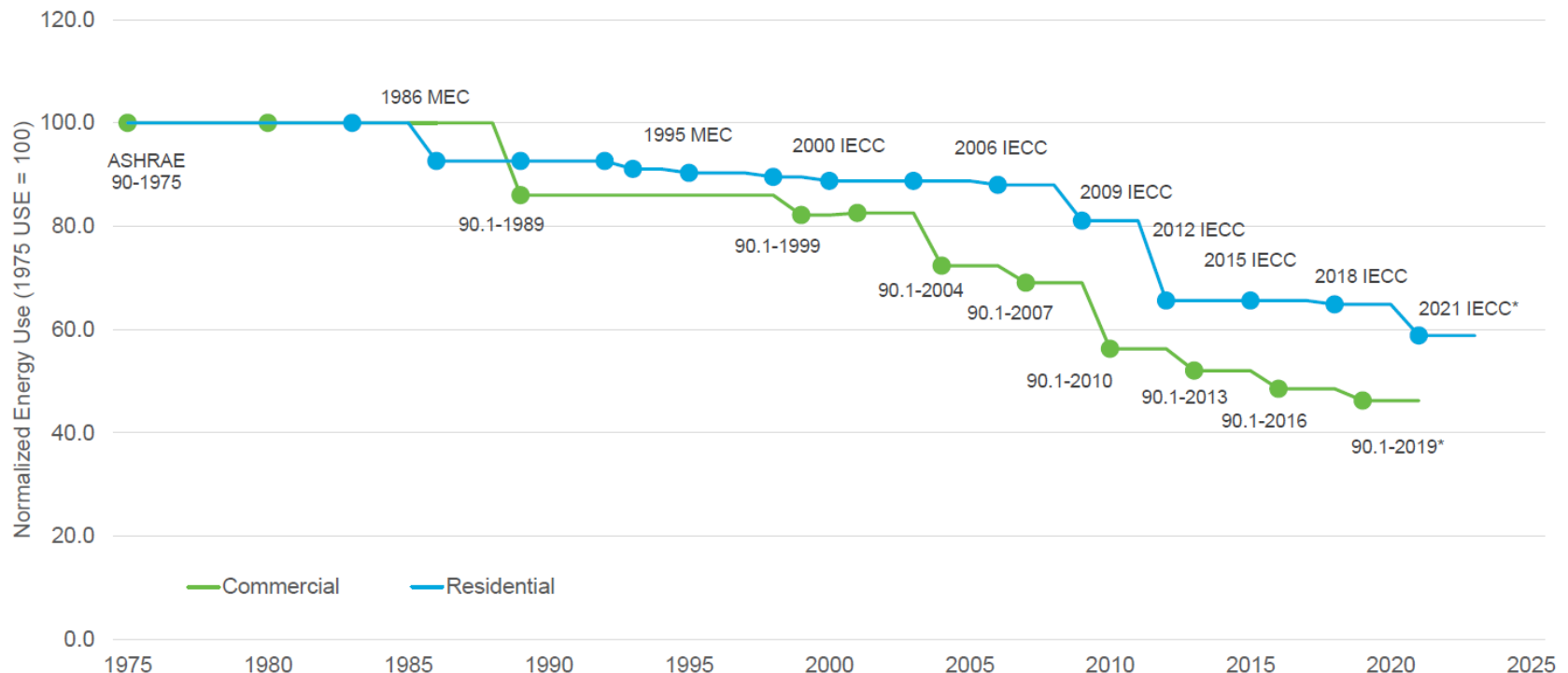


# Energy Code Improvements Over Time

## Historical Improvement: IECC and Standard 90.1

Improvement in Residential & Commercial Energy Code

(Year 1975-2021)



# Energy Code Improvements Over Time



## IECC - Residential

Model Code	Energy cost savings over previous edition
2006 IECC	1%
2009 IECC	10.5%
2012 IECC	23.9%
2015 IECC	0.73%
2018 IECC	1.97%
2021 IECC	8.66%

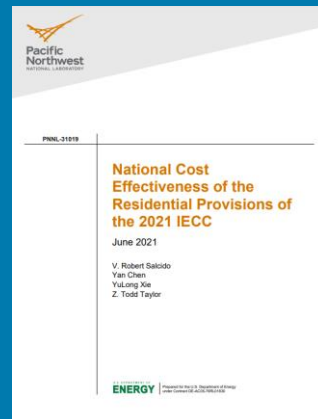
## ASHRAE - Commercial

Model Code	Energy cost savings over previous edition
90.1-2004	13.9%
90.1-2007	4.4%
90.1-2010	18.2%
90.1-2013	8.7%
90.1-2016	8.3%
90.1-2019	4.3%

# National Impact (average)

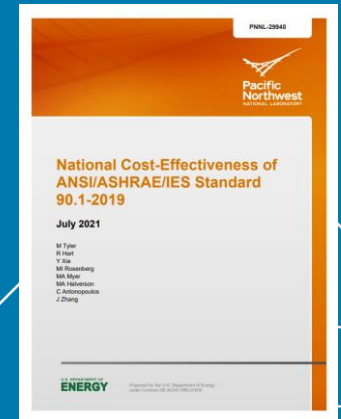
## 2021 IECC

- Life Cycle Savings: \$2,320
- Simple Payback: 10.5 yrs
- Years to Positive Cash Flow: 4



## ASHRAE Std. 90.1-2019

- Life Cycle Savings: \$4.12/sq.ft.



## 2021 IECC vs. MUBEC

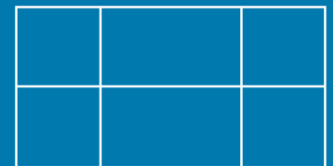
### Homeowners

- Life Cycle Savings:  
\$23,772
- Energy Cost Savings:  
23.5%
- Years to positive cash flow: <1
- Simple payback: 4.5 yrs

### Statewide

- CO2 Reduction over 30 yrs = 85,810 fewer cars
- Jobs: +69 in year 1;  
+1,742 over 30 years

Source: U.S. Dep't of Energy, *Cost-Effectiveness of the 2021 IECC for Residential Buildings in Maine* (July 2021).



# State Impact - Maine



## Std. 90.1-2019 vs. MUBEC

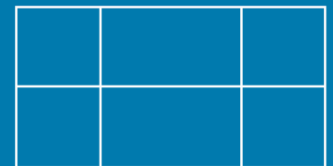
### Homeowners

- Life Cycle Savings:  
\$4.22/sq.ft.
- Energy Cost Savings:  
2.6-6.3%

### Statewide

- CO2 Reduction over 30 yrs = 163,500 fewer cars
- Jobs: +35 in year 1;  
+1,082 over 30 years

Source: U.S. Dep't of Energy, *Cost-Effectiveness of ANSI/ASHRAE/IES Standard 90.1-2019 for Maine* (July 2021).

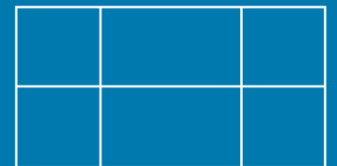


# Key Points on 2021 IECC



## 2021 IECC is a Course Correction

- Many improvements already implemented by states or adjacent climate zones
- Multiple compliance options and alternatives
- Reformatting to lay foundation for future improvements or stretch energy codes
- Facilitates net-zero and decarbonization goals





# Key Points on 2021 IECC

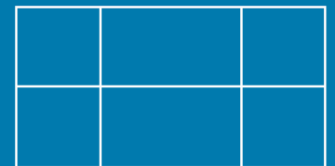


## Residential

- All compliance paths improved
- New Additional Efficiency Options
- Streamlining, refining
- Improved consumer safeguards
- Path to net-zero

## Commercial

- All compliance paths improved
- Revised Efficiency Options
- Consistency with ASHRAE Std. 90.1
- Improved consumer safeguards
- Path to net-zero



# Large-Scale, Reformatting Changes Impacting Energy Efficiency

## Updated Climate Zones

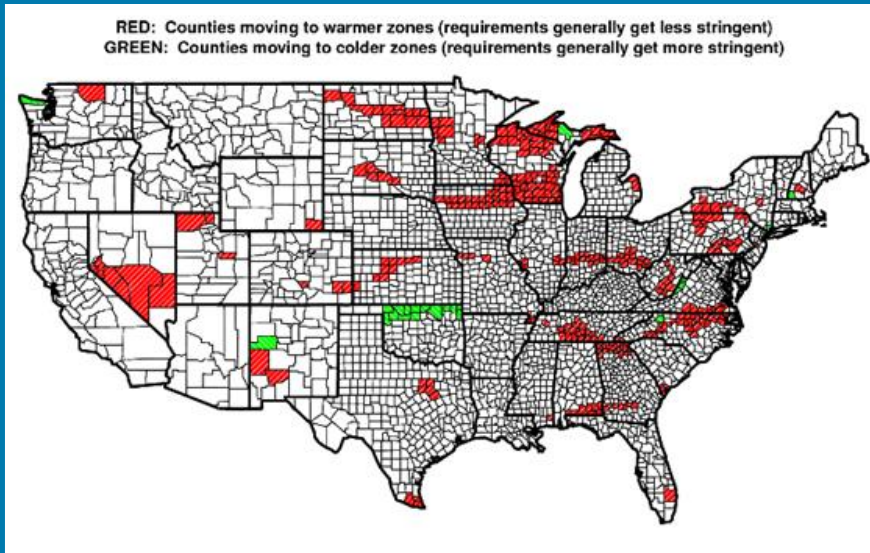


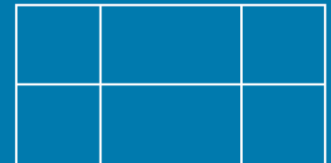
Figure 2 from Pacific Northwest National Laboratory, *Impact of ASHRAE Standard 169-2013 on Building Energy Codes and Energy Efficiency* (Aug. 2016).

## “Mandatory” Provisions Move into Tables

**TABLE R406.2 (IRC N1106.2)**  
**REQUIREMENTS FOR ENERGY RATING INDEX**

Section <sup>a</sup>	Title
<b>General</b>	-
R401.3	Certificate
<b>Building Thermal Envelope</b>	
R402.1.1	Vapor Retarder
R402.4	Air Leakage
R406.3	Building Thermal Envelope
<b>Systems</b>	
R403.1	Controls
R403.3 except sections R403.3.1, R403.3.4, R403.3.6, and R403.3.7	Ducts
R403.4	Mechanical system piping insulation
R403.5.1	Heated water circulation and temperature maintenance systems
R403.6	Mechanical ventilation
R403.7	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice systems
R403.10	Pools and permanent spa energy consumption
R403.11	Portable spas
R403.12	Residential pools and permanent residential spas
<b>Electrical Power and Lighting Systems</b>	
R404.1	Lighting equipment

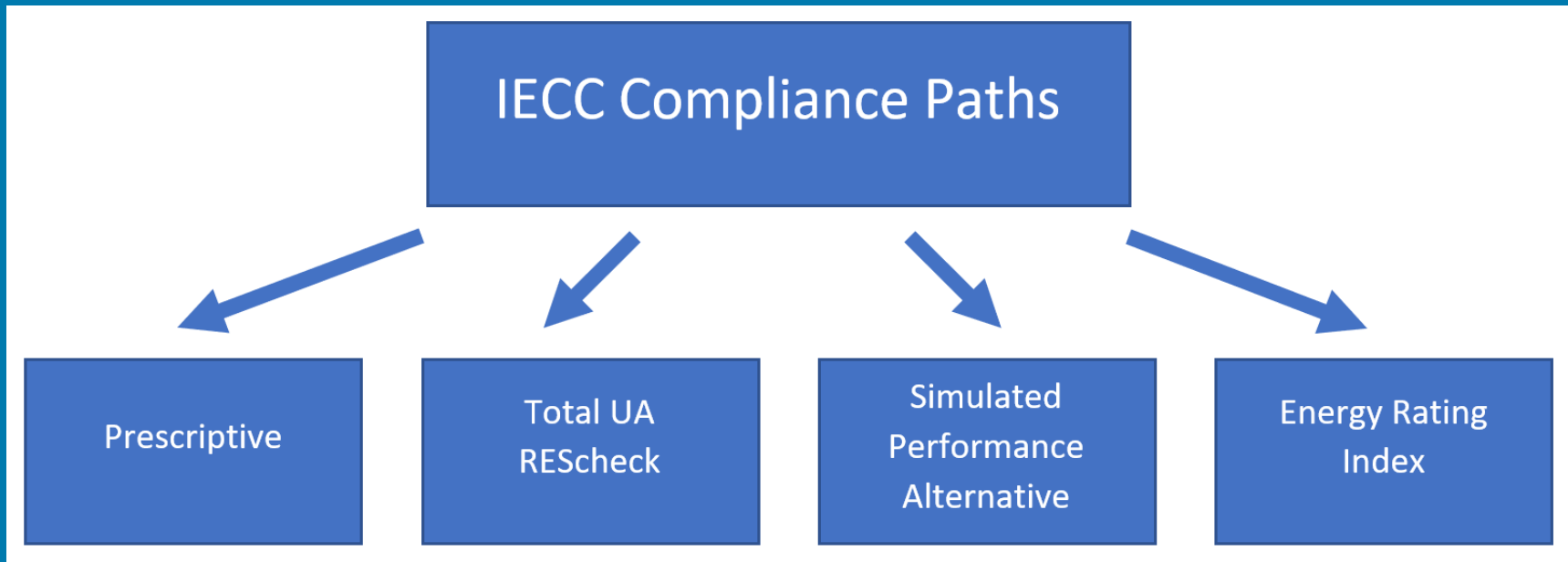
From Proposal CE42-19 Part II.



# 2021 IECC: Residential Improvements by compliance path



# 2021 IECC: Residential Improvements by compliance path

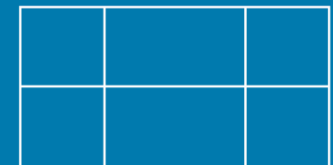



# 2021 IECC: Prescriptive



**TABLE R402.1.4 R402.1.2**  
**EQUIVALENT MAXIMUM ASSEMBLY U-FACTORS AND FENESTRATION REQUIREMENTS<sup>a</sup>**

CLIMATE ZONE	FENESTRATION U-FACTOR <sup>f</sup>	SKYLIGHT U-FACTOR	<u>GLAZED FENESTRATION SHGC<sup>d,e</sup></u>	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR <sup>b</sup>	FLOOR U-FACTOR	BASEMENT <sup>c</sup> WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
1	0.50	0.75	<u>0.25</u>	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	<u>0.25</u>	<del>0.030</del> <u>0.026</u>	0.084	0.165	0.064	0.360	0.477
3	<del>0.32</del> <u>0.30</u>	0.55	<u>0.25</u>	<del>0.030</del> <u>0.026</u>	0.060	0.098	0.047	0.091 <sup>c</sup>	0.136
4 except Marine	<del>0.32</del> <u>0.30</u>	0.55	<u>0.40</u>	<del>0.026</del> <u>0.024</u>	<del>0.060</del> <u>0.045</u>	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	NR <u>0.40</u>	<del>0.026</del> <u>0.024</u>	<del>0.060</del> <u>0.045</u>	0.082	0.033	0.050	0.055
6	0.30	0.55	NR	<del>0.026</del> <u>0.024</u>	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	NR	<del>0.026</del> <u>0.024</u>	0.045	0.057	0.028	0.050	0.055



# 2021 IECC: Prescriptive



**TABLE R402.1.2 R402.1.3  
INSULATION MINIMUM R-VALUE AND FENESTRATION REQUIREMENTS BY COMPONENT<sup>a</sup>**

CLIMATE ZONE	FENESTRATION U-FACTOR <sup>b,j</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>i</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
0 & 1	NR	0.75	0.25	30	13 or 0+10ci <sup>h</sup>	3/4	13	0	0	0
2	0.40	0.65	0.25	<del>38</del> 49	13 or 0+10ci <sup>h</sup>	4/6	13	0	0	0
3	<del>0.32</del> 0.30 <sup>i</sup>	0.55	0.25	<del>38</del> 49	20 or 13+5ci <sup>h</sup> or 0+15ci <sup>h</sup>	8/13	19	5ci or 13 <sup>f</sup>	0 10, 2 ft	5ci or 13
4 except Marine	<del>0.32</del> 0.30 <sup>i</sup>	0.55	0.40	49 60	30 or 20+5ci or 13+510ci <sup>h</sup> or 0+20ci <sup>h</sup>	8/13	19	10ci or 13	10ci, ≥ 4 ft	10ci or 13
5 and Marine 4	0.30 <sup>i</sup>	0.55	NR 0.40	49 60	30 or 20+5ci or 13+510ci <sup>h</sup> or 0+20ci <sup>h</sup>	13/17	30 <sup>#</sup>	15ci or 19 or 13+5ci	10ci, ≥ 4 ft	15ci or 19 or 13+5ci
6	0.30 <sup>l</sup>	0.55	NR	49 60	30 or 20+5ci <sup>h</sup> or 13+10ci <sup>h</sup> or 0+20ci <sup>h</sup>	15/20	30 <sup>#</sup>	15ci or 19 or 13+5ci	10ci, 4 ft	15ci or 19 or 13+5ci
7 and 8	0.30 <sup>l</sup>	0.55	NR	49 60	30 or 20+5ci <sup>h</sup> or 13+10ci <sup>h</sup> or 0+20ci <sup>h</sup>	19/21	38 <sup>#</sup>	15ci or 19 or 13+5ci	10ci, 4 ft	15ci or 19 or 13+5ci

## New exception for windows in high-altitude or wind-borne debris protection areas

### **U-factor Table new fenestration footnote**

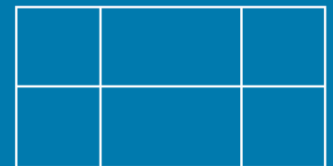
A maximum U-factor of 0.32 shall apply in Climate zone Marine 4 and Climate Zones 5 through 8 to vertical fenestration products installed in buildings located either:

1. Above 4000 feet in elevation above sea level, or
2. In windborne debris regions where protection of openings is required by Section R301.2.1.2 of the International Residential Code.

### **R-value Table new fenestration footnote**

A maximum U-factor of 0.32 shall apply in Climate Zones 3 through 8 to vertical fenestration products installed in buildings located either:

1. Above 4000 feet in elevation above sea level, or
2. In windborne debris regions where protection of openings is required by Section R301.2.1.2 of the International Residential Code.

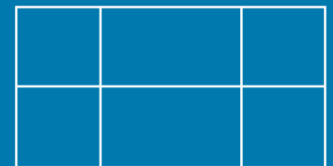


## Eliminated loophole for floor insulation

**Table R402.1.2, footnote g.** [Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.]

## Eliminated loophole for wall insulation

**R402.2.7** [Walls with partial structural sheathing. Where Section R402.1.2 requires continuous insulation on *exterior walls* and structural sheathing covers 40 percent or less of the gross area of all *exterior walls*, the required continuous insulation R-value shall be permitted to be reduced by an amount necessary, but not more than R-3 to result in a consistent total sheathing thickness on areas of the walls covered by structural sheathing. This reduction shall not apply to the *U-factor* alternative in Section R402.1.4 and the Total UA alternative in Section R402.1.5.]





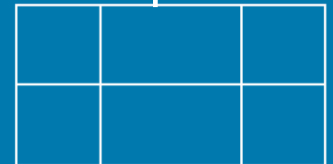
## Envelope Tightness and Testing

- All new homes still required to be blower door tested.
- Baseline for envelope leakage is still  $\leq 3.0$  ACH50.
  - However, in performance path and ERI, envelope leakage may be traded up to  $\leq 5.0$  ACH50 in Performance or ERI, as long as efficiency losses are accounted for.
- Small units (<1500 sq. ft.) may be tested to  $\leq 0.30$  cfm/sq.ft enclosure area.
- No sampling allowed.
- Note: One of the Additional Efficiency Options is a measured air leakage rate  $\leq 3.0$  ACH50 plus HRV/ERV.



## Duct Tightness and Testing

- All new homes required to have ducts tested.
  - No more exception for homes with ducts/air handler inside conditioned space.
- Maximum leakage allowable for systems located inside conditioned space AND maximum trade-off for duct leakage is  $\leq 8.0$  cfm/100 sq.ft.
  - Prescriptive requirement and baseline for performance path trade-offs is  $\leq 4.0$  cfm/100 sq.ft. or  $\leq 3.0$  cfm/100 sq.ft. if air handler is not installed.
- Note: One of the Additional Efficiency Options is to locate 100% of ducts and air handlers inside the envelope/inside conditioned space.
- No sampling allowed.



## Prescriptive: (pick one)

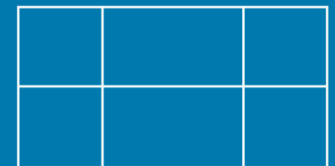
- 5% improved envelope UA and SHGC
- Improved heating and cooling equipment
  - $\geq 95$  AFUE nat. gas + 16 SEER air conditioner
  - $\geq 10$  HSPF/16 SEER air source heat pump
  - $\geq 3.5$  COP ground source heat pump
- Improved water heating equipment
  - $\geq .82$  EF fossil fuel water heater
  - $\geq 2.0$  EF electric water heater
  - $\geq 0.4$  SF solar water heater
- Ducts inside conditioned space
  - 100% ducts/air handler entirely within thermal envelope
  - 100% ductless system or hydronic system entirely within thermal envelope
  - 100% thermal distribution system inside conditioned space (per R403.3.7)
- Air leakage  $\leq 3$  ACH50 + ERV/HRV



# 2021 IECC: Prescriptive Trade-off Backstops



Trade-Off	2018 IECC	2021 IECC
Envelope Air Leakage	$\leq 3$ ACH50 in cz 3-8 $\leq 5$ ACH50 in cz 1-2	$\leq 3.0$ ACH50 $\leq 5.0$ ACH50 in cz 1-2 Or for small units (<1500 sq. ft.), $\leq 0.30$ cfm/sq.ft. enclosure area
Duct Tightness	Exemption for system with all ducts & air handler inside conditioned space	Maximum leakage limit for all systems: $\leq 8.0$ cfm/sq.ft.



# 2021 IECC: Performance



- New Table of Mandatory Measures
- Includes improvements in prescriptive tables, lighting efficiency, etc.
- Requires compliance with Additional Efficiency Options or 5% improvement over Standard Reference
- Trade-offs and Backstops
  - Flexibility in air tightness (up to 5.0 ACH50)
  - New backstop on duct tightness (8.0 cfm/100sq.ft.)
  - New thermal envelope backstop (2009 IECC)
  - No equipment trade-offs
  - No onsite power trade-offs



# 2021 IECC: Performance

**TABLE R405.2 (IRC N1105.2)  
REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE**

Section <sup>a</sup>	Title
<b>General</b>	
R401.3	Certificate
<b>Envelope</b>	
R402.1.1	Vapor Retarder
R402.4	Air Leakage
R402.5	Maximum fenestration U-factor and SHGC
<b>Mechanical</b>	
R403.1	Controls
R403.3, except sections R403.3.1, R403.3.4, R403.3.6 and R403.3.7	Ducts
R403.4	Mechanical system piping insulation
R403.5.1	Heated water circulation and temperature maintenance systems
R403.6	Mechanical ventilation
R403.7	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice systems
R403.10	Pools and permanent spa energy consumption
R403.11	Portable spas
<b>Electrical Power and Lighting Systems</b>	
R404.1	Lighting equipment

<sup>a</sup> Reference to a code section includes all the relative subsections except as indicated in the table.

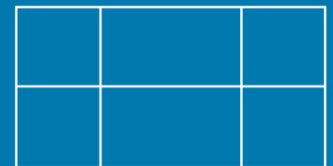
## Additional Efficiency Options - Performance

### Pick one:

- 5% improved envelope UA and SHGC
- Improved heating and cooling equipment
- Improved water heating equipment
- Ducts inside conditioned space
- Air leakage  $\leq 3$  ACH50 + ERV/HRV

### OR:

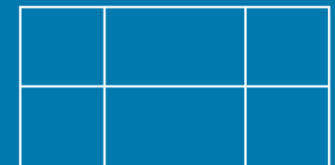
- Demonstrate 5% improvement over standard reference design



# 2021 IECC: Performance Trade-off Backstops



Trade-Off	2018 IECC	2021 IECC
<b>Envelope Air Leakage</b>	<p>≤3 ACH50 in cz 3-8                      ≤5 ACH50 in cz 1-2</p>	<p>Baseline: ≤3.0 ACH50 in cz 3-8,                      ≤5.0 ACH50 in cz 1-2                      Mandatory trade-off maximum for all cz: ≤5.0 ACH50 for all cz</p>
<b>Duct Tightness</b>	<p>Exemption for system with all ducts &amp; air handler inside conditioned space</p>	<p>Maximum leakage limit for all systems: ≤8.0 cfm/sq.ft.</p>
	<p>No limit on duct leakage in trade-offs</p>	<p>Maximum trade-off limit for duct leakage: ≤8.0 cfm/sq.ft.</p>
<b>Envelope Efficiency</b>	<p>No limit on envelope trade-offs</p>	<p>Envelope efficiency must be no weaker than 2009 IECC prescriptive table</p>





# 2021 IECC: Energy Rating Index



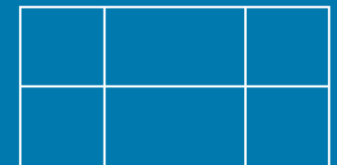
CLIMATE ZONE	2015 IECC	2018 IECC	2021 IECC BASELINE	BASELINE + 5% EFFICIENCY
1	52	57	52	49
2	52	57	52	49
3	51	57	51	48
4	54	62	54	51
5	55	61	55	52
6	54	61	54	51
7	53	58	53	50
8	53	58	53	50



# 2021 IECC: Energy Rating Index Trade-off Backstops



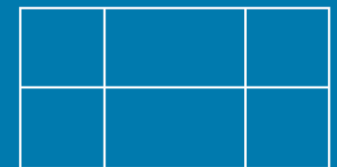
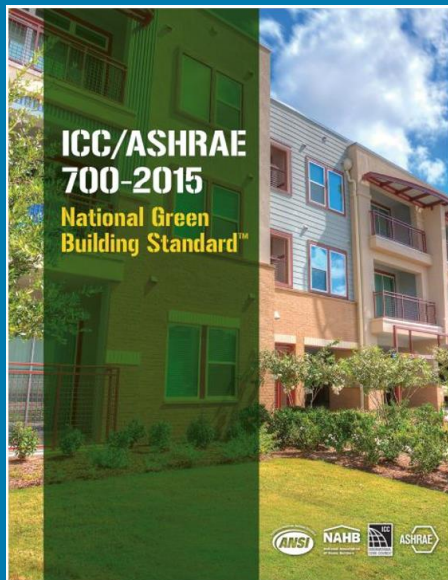
Trade-Off	2018 IECC	2021 IECC
<b>Envelope Air Leakage</b>	$\leq 3$ ACH50 in cz 3-8 $\leq 5$ ACH50 in cz 1-2	Mandatory trade-off maximum: $\leq 5.0$ ACH50 for all cz
<b>Duct Tightness</b>	Exemption for system with all ducts & air handler inside conditioned space	Maximum leakage limit for all systems: $\leq 8.0$ cfm/sq.ft.
	No limit on duct leakage in trade-offs	Maximum trade-off limit for duct leakage: $\leq 8.0$ cfm/sq.ft.
<b>Envelope Efficiency (No onsite power production)</b>	2009 IECC prescriptive table	Total UA of 2021 IECC X 1.15
<b>Envelope Efficiency (including onsite power production)</b>	2015 IECC prescriptive table	2018 IECC prescriptive table
<b>Onsite power production</b>	No limit to trade-off credit	Limited to 5% credit for onsite power production



# 2021 IECC: Above-Code Program Backstops



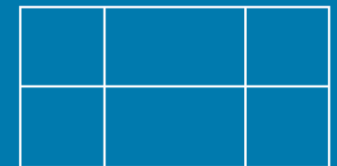
Trade-Off	2018 IECC	2021 IECC
Envelope Efficiency	No limit on envelope trade-offs	2009 IECC prescriptive table
Mandatory Requirements	Project must meet all mandatory requirements	Project must meet all mandatory requirements



# 2021 IECC: Other Changes

- Improved Lighting Efficiency
  - $\geq 70$  lumens/watt, controls
- Energy Recovery Ventilation
  - Required in cz 7-8
- Mechanical Ventilation
  - Required for all homes
- Net-Zero Appendix
  - Available for adoption by jurisdictions with net-zero goals
  - Minimum envelope: 2015 IECC

Climate Zone	2021 IECC ERI Baseline (including 5% improvement)	Net-Zero Appx (not including OPP)	Net-Zero Appx (including OPP)
1	49	43	0
2	49	45	0
3	48	47	0
4	51	47	0
5	52	47	0
6	51	46	0
7	50	46	0
8	50	45	0

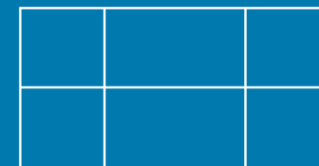


# 2021 IECC: Permanent Certificate (Residential)



- **R401.3 Certificate (Mandatory).** A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall indicate the following:

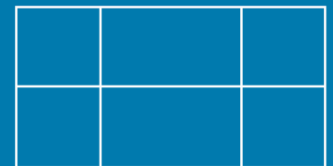
1. The predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, crawl space walls and floors and ducts outside *conditioned spaces*.
2. The *U*-factors of fenestration and the *solar heat gain coefficient* (SHGC) of fenestration. Where there is more than one value for each any component of the building thermal envelope, the certificate shall indicate both the value covering the largest area and the area-weighted average value if available.
3. The results from any required duct system and *building* envelope air leakage testing performed on the *building*.



# 2021 IECC: Permanent Certificate (Residential)



4. The types, sizes and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate “gas-fired unvented room heater,” “electric furnace” or “baseboard electric heater,” as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters.
5. Where onsite photovoltaic panel systems have been installed, the array capacity, inverter efficiency, panel tilt and orientation shall be noted on the certificate.
6. For buildings where an Energy Rating Index score is determined in accordance with Section R406, the Energy Rating Index score, both with and without any on-site generation, shall be listed on the certificate.
7. The code edition under which the structure was permitted and the compliance path used.



# 2021 IECC: Commercial Improvements by compliance path



# 2021 IECC: Prescriptive



**TABLE C402.1.3 - OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD<sup>a,1</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>																
Insulation entirely above roof deck	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal Buildings <sup>b</sup>	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-25 + R-11 LS	R-25 + R-11 LS R-11 LS R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS R-11 LS R-25 + R-11 LS R-11 LS	R-30 + R-11 LS R-11 LS R-25 + R-11 LS R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-38 R-49	R-38 R-49	R-38 R-49	R-49	R-49	R-49	R-49 R-60	R-49 R-60	R-49 R-60	R-49 R-60
<b>Walls, above grade</b>																
Mass <sup>c</sup>	R-5.7ci <sup>d</sup>	R-5.7ci <sup>d</sup>	R-5.7ci <sup>d</sup>	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal Building	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci R-13 + R-14ci	R-13 + R-13ci R-13 + R-14ci	R-13 + R-13ci R-13 + R-14ci	R-13 + R-13ci R-13 + R-14ci	R-13 + R-13ci R-13 + R-14ci	R-13 + R-13ci R-13 + R-17ci	R-13 + R-19.5ci	R-13 + R-13ci R-13 + R-19.5ci	R-13 + R-19.5ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci R-13 + R-10ci	R-13 + R-7.5ci R-13 + R-10ci	R-13 + R-7.5ci R-13 + R-10ci	R-13 + R-7.5ci R-13 + R-12.5ci	R-13 + R-7.5ci R-13 + R-12.5ci	R-13 + R-7.5ci R-13 + R-12.5ci	R-13 + R-7.5ci R-13 + R-18.8ci	R-13 + R-7.5ci R-13 + R-18.8ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20 R-13 + R-20 R-13 + R-7.5ci or R-20 R-13 + R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 R-13 + R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 R-13 + R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 R-13 + R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 R-13 + R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 R-13 + R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 R-13 + R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 R-13 + R-20 + R-3.8ci
<b>Walls, below grade</b>																
Below-grade wall <sup>d</sup>	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci R-10ci	R-7.5ci	R-7.5ci R-10ci	R-7.5ci R-10ci	R-7.5ci R-15ci	R-10ci R-15ci	R-10ci R-15ci	R-10ci R-15ci	R-12.5ci R-15ci
<b>Floors</b>																
Mass <sup>c</sup>	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci R-14.6ci	R-10ci R-16.7ci	R-10ci R-14.6ci	R-12.5ci R-16.7ci	R-12.5ci R-16.7ci	R-12.5ci R-16.7ci	R-15ci R-20.9ci	R-16.7ci R-20.9ci	R-15ci R-23ci	R-16.7ci R-23ci
Joist/framing	NR R-13	NR R-13	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30 R-38	R-30 R-38	R-30 R-38	R-30 R-38	R-30 R-38
<b>Slab-on-grade floors</b>																
Unheated slabs	NR	NR	NR	NR	NR	NR	R-10 for 24" below R-15 for 24" below	R-10 for 24" below R-15 for 24" below	R-10 for 24" below R-15 for 24" below	R-10 for 24" below R-20 for 24" below	R-10 for 24" below R-20 for 24" below	R-15 for 24" below R-20 for 24" below	R-15 for 24" below R-20 for 24" below	R-15 for 24" below R-20 for 24" below	R-15 for 24" below R-20 for 24" below	R-20 for 24" below R-25 for 24" below



# 2021 IECC: Prescriptive



**TABLE C402.1.4**  
**OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR METHOD<sup>a, b</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>																
Insulation entirely above roof deck	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal Buildings	<del>U-0.044</del> U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.031	<del>U-0.031</del> U-0.029	U-0.029	U-0.029	<del>U-0.029</del> U-0.026	<del>U-0.029</del> U-0.026
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	<del>U-0.027</del> U-0.021	<del>U-0.027</del> U-0.021	<del>U-0.027</del> U-0.021	U-0.021	U-0.021	U-0.021	<del>U-0.021</del> U-0.017	<del>U-0.021</del> U-0.017	<del>U-0.021</del> U-0.017	<del>U-0.021</del> U-0.017
<b>Walls, above grade</b>																
Mass <sup>d</sup>	U-0.151	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	<del>U-0.061</del> U-0.037	<del>U-0.061</del> U-0.037
Metal Building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	<del>U-0.052</del> U-0.050	<del>U-0.052</del> U-0.050	<del>U-0.052</del> U-0.050	<del>U-0.052</del> U-0.050	<del>U-0.052</del> U-0.050	<del>U-0.052</del> U-0.044	U-0.039	<del>U-0.052</del> U-0.039	U-0.039
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	<del>U-0.064</del> U-0.055	<del>U-0.064</del> U-0.055	<del>U-0.064</del> U-0.049	<del>U-0.064</del> U-0.049	<del>U-0.064</del> U-0.049	<del>U-0.052</del> U-0.042	<del>U-0.064</del> U-0.037	<del>U-0.045</del> U-0.037
Wood framed and other <sup>c</sup>	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	<del>U-0.064</del> U-0.051	<del>U-0.064</del> U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	<del>U-0.036</del> U-0.032	<del>U-0.036</del> U-0.032
<b>Walls, below grade</b>																
Below-grade wall <sup>c</sup>	C-1.140 <sup>e</sup>	C-1.140 <sup>e</sup>	C-1.140 <sup>e</sup>	C-1.140 <sup>e</sup>	C-1.140 <sup>e</sup>	C-1.140 <sup>e</sup>	C-0.119	<del>C-0.119</del> C-0.092	C-0.119	<del>C-0.119</del> C-0.092	<del>C-0.119</del> C-0.092	<del>C-0.119</del> C-0.063	<del>C-0.092</del> C-0.063	<del>C-0.092</del> C-0.063	<del>C-0.092</del> C-0.063	<del>C-0.092</del> C-0.063
<b>Floors</b>																
Mass <sup>d</sup>	U-0.322 <sup>a</sup>	U-0.322 <sup>a</sup>	U-0.107	U-0.087	<del>U-0.076</del> U-0.074	<del>U-0.076</del> U-0.074	<del>U-0.076</del> U-0.057	<del>U-0.074</del> U-0.051	U-0.074	U-0.064	U-0.064	U-0.064	U-0.055	U-0.051	U-0.055	U-0.051
Joist/framing	U-0.066 <sup>a</sup>	U-0.066 <sup>a</sup>	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	<del>U-0.033</del> U-0.027	<del>U-0.033</del> U-0.027	<del>U-0.033</del> U-0.027	<del>U-0.033</del> U-0.027	<del>U-0.033</del> U-0.027
<b>Slab-on-grade floors</b>																
Unheated slabs	F-0.73 <sup>a</sup>	F-0.73 <sup>a</sup>	F-0.73 <sup>a</sup>	F-0.73 <sup>a</sup>	F-0.73 <sup>a</sup>	<del>F-0.73<sup>a</sup></del> F-0.54	F-0.54	F-0.54	F-0.54	F-0.54	F-0.54	F-0.54	F-0.52	F-0.40	F-0.40	F-0.40
						F-0.54	F-0.52	F-0.52	F-0.52	F-0.51	F-0.51	F-0.51	F-0.434	F-0.51	F-0.434	F-0.424

# 2021 IECC: Prescriptive



**TABLE C402.4  
BUILDING ENVELOPE FENESTRATION MAXIMUM U-FACTOR AND SHGC REQUIREMENTS**

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8								
Vertical fenestration																
U-factor																
Fixed fenestration	0.50	<del>0.50</del> <u>0.45</u>	<del>0.46</del> <u>0.42</u>	<del>0.38</del> <u>0.36</u>	<del>0.38</del> <u>0.36</u>	<del>0.36</del> <u>0.34</u>	0.29	<del>0.29</del> <u>0.26</u>								
Operable fenestration	<del>0.65</del> <u>0.62</u>	<del>0.65</del> <u>0.60</u>	<del>0.60</del> <u>0.54</u>	0.45	0.45	<del>0.43</del> <u>0.42</u>	<del>0.37</del> <u>0.36</u>	<del>0.37</del> <u>0.32</u>								
Entrance doors	<del>1.10</del> <u>0.83</u>	<del>0.83</del> <u>0.77</u>	<del>0.77</del> <u>0.68</u>	<del>0.77</del> <u>0.63</u>	<del>0.77</del> <u>0.63</u>	<del>0.77</del> <u>0.63</u>	<del>0.77</del> <u>0.63</u>	<del>0.77</del> <u>0.63</u>								
Skylights																
U-factor	<del>0.75</del> <u>0.70</u>	0.65	0.55	0.50	0.50	0.50	<del>0.50</del> <u>0.44</u>	<del>0.50</del> <u>0.41</u>								
SHGC																
CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
Orientation* <del>SOUTH</del>	SEW Fixed	N Operable	SEW Fixed	N Operable	SEW Fixed	N Operable	SEW Fixed	N Operable	SEW Fixed	N Operable	SEW Fixed	N Operable	SEW Fixed	N Operable	SEW Fixed	N Operable
PF < 0.2	<del>0.25</del> <u>0.23</u>	<del>0.33</del> <u>0.21</u>	0.25	<del>0.33</del> <u>0.23</u>	0.25	<del>0.33</del> <u>0.23</u>	0.36	<del>0.48</del> <u>0.33</u>	0.38	<del>0.51</del> <u>0.33</u>	<del>0.40</del> <u>0.38</u>	<del>0.53</del> <u>0.34</u>	<del>0.45</del> <u>0.40</u>	NR <u>0.36</u>	<del>0.45</del> <u>0.40</u>	NR <u>0.36</u>
0.2 ≤ PF < 0.5	<del>0.30</del> <u>0.28</u>	<del>0.37</del> <u>0.25</u>	0.30	<del>0.37</del> <u>0.28</u>	0.30	<del>0.37</del> <u>0.28</u>	0.43	<del>0.53</del> <u>0.40</u>	0.46	<del>0.56</del> <u>0.40</u>	<del>0.48</del> <u>0.46</u>	<del>0.58</del> <u>0.41</u>	NR <u>0.48</u>	NR <u>0.43</u>	<del>NR</del> <u>0.48</u>	NR <u>0.43</u>
PF ≥ 0.5	<del>0.40</del> <u>0.37</u>	<del>0.40</del> <u>0.34</u>	0.40	<del>0.40</del> <u>0.37</u>	0.40	<del>0.40</del> <u>0.37</u>	0.58	<del>0.58</del> <u>0.53</u>	0.61	<del>0.61</del> <u>0.53</u>	<del>0.64</del> <u>0.61</u>	<del>0.64</del> <u>0.54</u>	NR <u>0.64</u>	NR <u>0.58</u>	<del>NR</del> <u>0.64</u>	NR <u>0.58</u>

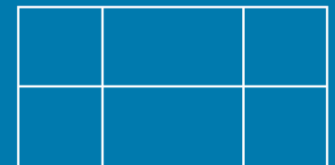
# 2021 IECC: Prescriptive

## New Points-Based Tables

- Replace Section C406 Additional Efficiency Options
- Tables for occupancy groups B, R & I, E, M, and “other.”
- Code users required to achieve 10 points.

**TABLE C406.1(1)**  
**Additional Energy Efficiency Credits for Group B Occupancy**

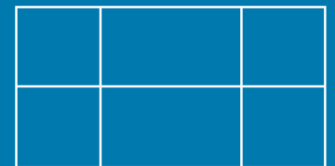
Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	1	1	NA	1
C406 .2.2: 5% Cooling Eff Imprv.	6	6	5	5	4	4	3	3	3	2	2	2	1	2	2	2	1
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	2	1	1	2	2	NA	1
C406 .2.4: 10 % Cooling Eff Imprv.	11	12	10	9	7	7	6	5	6	4	4	5	3	4	3	3	3
C406 .3: Reduced Light Power	9	8	9	9	9	9	10	8	9	9	7	8	8	6	7	7	6
C406 .4: Enh. Digital Light Ctrl	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1
C406 .5.1: On-site Renewable Eqv.	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
C406 .6 : Dedicated OA Sys (DOAS)	4	4	4	4	4	3	2	5	3	2	5	3	2	7	4	5	3
C406 .7.2: Recovered/Renew SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .7.3: Eff fossil fuel SWH <sup>b</sup>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .7.4: Heat Pump SWH <sup>b</sup>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .8: Enhanced Envelope Perf	1	4	2	4	4	3	NA	7	4	5	10	7	6	11	10	14	16
C406 .9: Reduced Air Infiltration	2	1	1	2	4	1	NA	8	2	3	11	4	1	15	8	11	6



# 2021 IECC: Performance

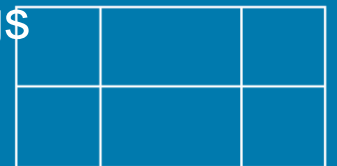


- Includes all improvements to prescriptive tables in standard reference baseline
- Must demonstrate 80% of standard reference design (improved from 85%)
- Eliminated wall insulation loophole
- New table of mandatory measures



## Envelope Tightness and Testing

- Air leakage testing for buildings and dwelling units in Group R and I occupancies to  $\leq 0.30$  cfm/sq.ft.
  - Exceptions for certain climate zones
  - Sampling permitted for buildings with  $> 8$  testing units)
- Air leakage testing for non-residential buildings to  $\leq 0.40$  cfm/sq.ft.
  - Exceptions for certain climate zones and other circumstances.
- New air barrier commissioning requirement
- New thermal envelope certificate for commercial buildings



# 2021 IECC: Other Improvements

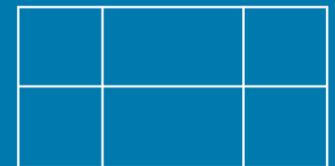


## Lighting/Mechanical

- HVAC tables updated to match ASHRAE 90.1-2019
- Improved lighting efficiency and controls across the board
- New photon-efficiency requirements for lighting for plant growth and maintenance
- Fault detection and diagnostics, energy monitoring, etc.
- Automatic receptacle controls

## Net-Zero Appendix

- AIA-endorsed proposal requires enough on-site or off-site renewable energy to offset building energy use



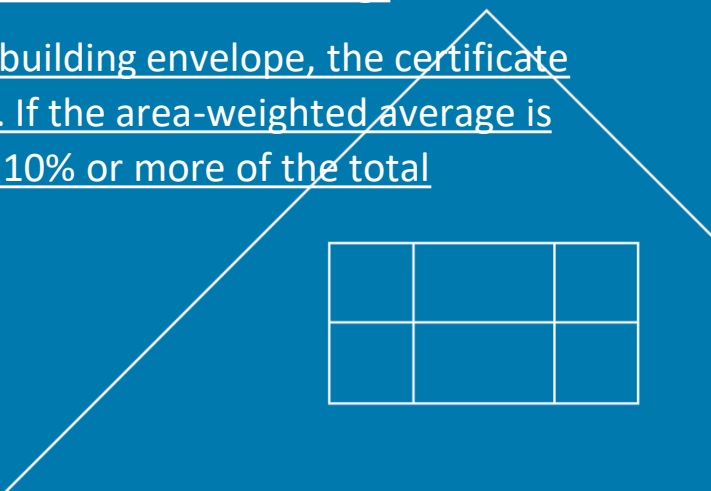
# 2021 IECC: Permanent Certificate (Commercial)



**C401.3 Thermal envelope certificate (Mandatory).** A permanent thermal envelope certificate shall be completed by an approved party. Such certificate shall be posted on a wall in the space where the space conditioning equipment is located, a utility room or other approved location. If located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. A copy of the certificate shall also be included in the construction files for the project. The certificate shall include:

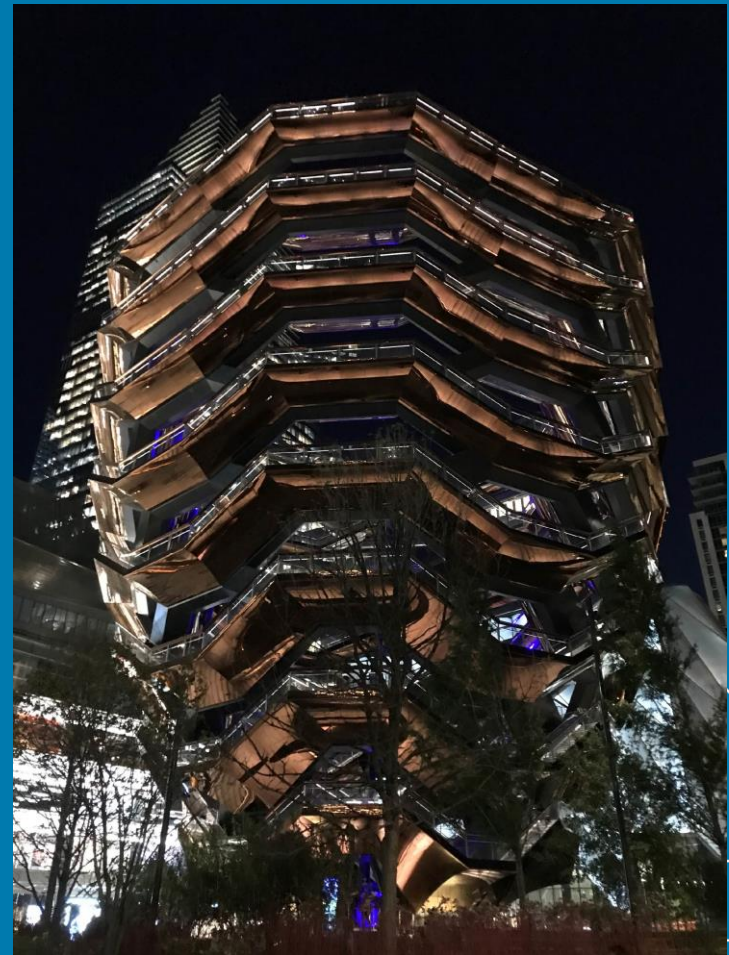
1. R-values of insulation installed in or on ceilings, roofs, walls, foundations and slabs, *basement walls, crawl space walls* and floors and ducts outside *conditioned spaces*.
2. U-factors and *solar heat gain coefficients (SHGC)* of fenestration.
3. Results from any *building* envelope air leakage testing performed on the *building*.

Where there is more than one value for any component of the building envelope, the certificate shall indicate the area-weighted average value where available. If the area-weighted average is not available, the certificate shall list each value that applies to 10% or more of the total component area.




# 2021 IECC: What Was **NOT** Approved

- No efficiency rollbacks
- No new loopholes for roof replacement
- No changes to scope or intent of IECC







**Please Note: This presentation is based on my notes and information available to the public, and I cannot guarantee 100% accuracy. It should not be used as a replacement for the actual printed code, nor should it be treated as an official interpretation of code requirements.**

# **Thank You**

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