FSEC Energy Research Center

UNIVERSITY OF CENTRAL FLORIDA

Comparison of the Residential Provisions of the 2020 Florida Building Code, Energy Conservation, 7th Edition with the 2021 IECC

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Executive Summary

This study provides a comparison between the residential provisions of the 7th Edition (2020) Florida Building Code, Energy Conservation (referred to here as the FBC-EC) and 2021 International Energy Conservation Code (IECC), based on approved 2018 to 2021 IECC changes included in the International Code Council's *Code Changes Resource Collection: 2021 IECC* document. The commercial provision changes are addressed in a separate parallel report.

The first part of the study involved developing code change listings based on the *Code Changes Resource Collection* document that identify changes that have potential energy and cost impacts. The second part of the study provides a stringency evaluation and cost-benefit analysis for those changes that impact energy use, to provide guidance for the upcoming 2020 FBC-EC to 2023 FBC-EC change cycle.

The code change listings part of the study was completed with the submission of the interim report on March 15, 2021 and presentation to the Energy Technical Advisory Committee (TAC) on April 5, 2021. The code change listing is included as the appendix to this report for reference.

This second part of the project has the following residential code subtasks:

a. Computer simulations using EnergyGauge® USA to estimate overall Prescriptive and Performance stringency differences between the 2021 IECC and 2020 FBC-EC
b. Summarizing the differences between Energy Rating Index (ERI) compliance requirements in the 2020 FBC-EC and the 2021 IECC
c. Cost benefit analysis of moving the residential Energy Code from the 2020 FBC-EC to 2021 IECC for those items that impact energy use.

The authors have reviewed the changes made for the 2021 IECC and evaluated whether each change is likely to have any impact or is just a clarification. For the residential measures that have a significant impact, energy analysis is included.

The 2021 IECC's most significant change is the additional energy efficiency requirements under new Section R401.2.5:

> This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.
>
> 1. For buildings complying with Section R401.2.1 [Prescriptive compliance], one of the additional efficiency package options shall be installed according to Section R408.2.
>
> 2. For buildings complying under Section R401.2.2 [Performance compliance], 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 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.

This report examines a number of ways of complying with this new requirement. For the Prescriptive compliance path, Section R408.2 offers builders the choice of any of five different additional efficiency package options. Analysis indicates savings for a typical single family home in Florida will vary greatly depending on which option is chosen. One option is upgraded water heating systems and those appear cost effective. Another option is a 5% improvement in SHGC and overall project *U*-value and that may be a low cost compliance method for certain projects. Other options include improved heating/cooling systems, ductless systems or ductwork inside thermal envelope or conditioned space, and a high efficacy ERV system.

For buildings complying with the Section R405 Total Building Performance Option (most current Florida projects) a builder can choose to comply using one of those R408.2 options as long as the home can achieve the required 1.0 e-Ratio without that measure. Another option for homes complying with the Total Building Performance Option is to achieve an e-Ratio of 0.95. This allows maximum flexibility of envelope and equipment components as Florida allows trade-offs in its Performance methodology.

For buildings complying with the Energy Rating Index (ERI) methodology Section R401.2.5 requires a 5% reduction from the maximum Table R406.5 ERI values, again allowing great flexibility.

This Section R401.2.5 additional efficiency requirements change is a departure from the historic methodologies. Whereas Prescriptive code in the past was all envelope related and had no options, now one of the five efficiency package options will have to be included and communicated to the official and four of the five options involve equipment, not envelope. The change also adds some more complexity to the Performance code although one can envision designers simply trying to meet an e-Ratio of 0.95 instead of 1.0. And the ERI change would simply set a new target.

Overall the authors provide four reasons for moving the 2021 IECC Section R401.2.5 change into the FBC-EC:

- It allows flexibility such that builders should be able to find a measure that works for their project

- One or more measures should prove cost effective for a project which is often the basis of the code modifications
- Without adopting this measure or something similar it will be difficult for the residential FBC-EC to show equivalence to the IECC
- With greater use, some of these options may come down in cost, improving cost effectiveness over time.

Another significant 2021 IECC change increases the *R*-value of ceiling insulation for Prescriptive compliance in Climate Zone 2 from the FBC-EC and 2018 IECC level of R-38 to R-49. The *U*-factor of the ceiling used in the standard reference design of the 2021 IECC Performance compliance method also becomes similarly more stringent. FSEC analysis found that if this option on its own added an estimated $770 first cost for a 2,000 square foot single story Tampa home, it would not be cost effective.

Another change in the 2021 IECC is going from a 90% requirement of high efficacy lighting to 100%. This reflects the current availability of high efficacy light fixtures and bulbs for virtually every reasonable light fixture. The cost premium for high efficacy lights is also very small. The difference from a June 2021 Lowe's visit was $1 per 16-pack of bulbs or about $0.06 a bulb. This change is highly cost effective and recommended.

There is a more significant lighting change and that is for existing homes. Section R503.1.4 of the 2021 IECC requires new lighting systems that are part of an alteration to comply with the lighting requirements and changes the exception from alterations that replace less than 50 percent of the lighting to those that replace less than 10%. This change has very small cost and is a good investment and is recommended for adoption.

Two other 2021 IECC changes involve lighting control requirements-- one for interior lighting and one for exterior lighting. Based on anticipated cost effectiveness, the interior control requirement is recommended and the exterior control requirement is not recommended.

There are a number of other changes provided in the report that address installation practices, some specific exceptions and language meant to be clarifying. Of two new exceptions considered, one is recommended (attic hatch insulation of R-13 instead of ceiling level) and one is not (language allowing ductwork in exterior walls and floor cavities to be considered in conditioned space based on certain other parameters being in place). Two 2021 IECC changes are not recommended because the language leaves great room for interpretation. Two other changes are not recommended due to applicability in Florida.

One 2021 IECC change creates a thermal envelope efficiency backstop for all Performance projects. This backstop would likely impact the current building practice of a number of concrete block homes. Another change would rarely apply to Florida as it would only apply for duct systems not in attics or conditioned space.

The Florida Building Commission will need to determine if they want to update the code based on cost effectiveness criteria in which case some of the 2021 IECC changes should apply and some should not. Some of the clarifying language and installation practice code changes should be considered and discussed among stakeholders.

As discussed throughout this report, the biggest change is the Section R401.2.5 additional energy efficiency requirements. Without adopting that change or a similar one, it will be difficult to continue to show Florida's code is equivalent to the latest I-code.

Contents

Introduction

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Prescriptive and Performance compliance option stringency differences between the 2020 FBC-EC and 2021 IECC

EnergyGauge USA energy modeling software approved for 7th Edition (2020) FBC-EC compliance calculations was used to compare the overall Prescriptive and Performance compliance method stringency differences between the 2020 FBC-EC and 2021 IECC.

Prescriptive Compliance Simulations

The Prescriptive compliance method simulations compare a 7th Edition (2020) FBC-EC compliant all electric 2,000 sq. ft., 1-story, single-family sample home with the same home that is 2021 IECC compliant in three Florida cities: Miami, Tampa and Jacksonville. Miami represents IECC Climate Zone (CZ) 1 and Tampa and Jacksonville are both in CZ 2.

Stemming from ICC code change RE209-19, all residential Chapter 4 2021 IECC compliance options must now include additional energy efficiency per Section R401.2.5. For Prescriptive compliance, one of the additional efficiency packages provided in new Section R408.2 must be installed.

To assess the impact of this requirement, each of the Section R408.2 package options was simulated as follows.

- R408.2.1 Enhanced Envelope Performance Option was simulated via reduced window *U*-factors and SHGCs as needed to get to 0.95 UA and 0.95 SHGC
- R408.2.2 More Efficient HVAC Equipment Performance Option was simulated per the equipment efficiency options stipulated in the code:
    a. SEER 16 AC and 95 AFUE Nat. Gas Furnace
    b. SEER 16 / HSPF 10 Air Source Heat Pump
    c. 3.5 COP Ground Source Heat Pump was not run as rarely used in Florida
- R408.2.3 Reduced Energy Use in Service Water-Heating Option was simulated per the water heater efficiency options stipulated in the code:
    a. 82 EF Fossil Fuel Service Water-Heating System via tankless gas water heater with 0.82 EF
    b. 2.0 EF Electric Service Water-Heating System via 3.45 UEF heat pump water heater (2.0 EF electric water heaters are not currently available and 3.45 and higher UEF efficiencies are now readily available)
    c. 0.4 Solar Fraction Solar Water-Heating System via 29 sq. ft. closed loop solar thermal system (this is higher than 0.4 solar fraction but more representative of Florida solar thermal sales)
- R408.2.4 More Efficient Duct Thermal Distribution System Option was simulated per the duct distribution options stipulated in the code:
    a. 100% of Ducts and Air Handlers in Building Thermal Envelope by moving the ceiling insulation to the roof while keeping ductwork in the attic which becomes unvented
    b. 100% of Ductless or Hydronic Thermal Dist. System in Building Thermal Envelope via running ductless air conditioning and heating
    c. 100% of Duct Thermal Distribution System in Conditioned Space per Section R403.3.2 via running supply and return ducts in the main conditioned space
- R408.2.5 Improved Air Sealing and Efficient Ventilation System Option was simulated with a 3.0 ACH50 infiltration rate and a 1.2 cfm/watt fan efficacy (instead of this section's 1.1 cfm/watt minimum) and 0.75 enthalpy recovery ventilator.

Two additional 2021 IECC changes were identified that apply to typical Prescriptive compliance— 1) an increase in the Prescriptive ceiling insulation requirement for Climate Zone 2 (CZ2) from R-38 to R-49 and from a *U*-factor of 0.030 to 0.026, and 2) a mandatory high efficacy lighting requirement increase from 90% to 100%. Base Prescriptive comparison house characteristics (without additional efficiency packages) are shown in Table 1.

Table 1. Prescriptive Comparison House Characteristics. Red type represents increased stringency of one energy code versus the other.

Component	Climate Zone 1		Climate Zone 2	
	2021 IECC	2020 FBC-EC	2021 IECC	2020 FBC-EC
Conditioned floor area (ft^2)	2,000	2,000	2,000	2,000
Foundation type	SOG	SOG	SOG	SOG
Floor perimeter R-value	0	0	0	0
Wall type	Wood Frame	Wood Frame	Wood Frame	Wood Frame
Wall insul. R-value	13	13	13	13
Wall solar absorptance	0.75	0.75	0.75	0.75
Window area (ft^2)	300	300	300	300
Window U-factor	0.5	0.5	0.4	0.4
Window SHGC	0.25	0.25	0.25	0.25
Roofing material	Comp. Shingles	Comp. Shingles	Comp. Shingles	Comp. Shingles
Roof solar absorptance	0.92	0.92	0.92	0.92
Attic ventilation	Vented 1/300	Vented 1/300	Vented 1/300	Vented 1/300
Ceiling insul. R-value	30	30	49	38
Envelope ACH50 (air chng. / hour @ 50pa)	5.0	7	5.0	7
AC SEER, Electric Heating System	14, Resistance	14, Resistance	14, Resistance	14, Heat Pump HSPF 8.2
Natural gas furnace AFUE	0.80	0.80	0.80	0.80
AHU location	Garage	Garage	Garage	Garage
Duct insul. R-value	8	8	8	8
Duct location	Attic	Attic	Attic	Attic
Duct leakage	Qn_{out}= 0.04	Qn_{out}= 0.04	Qn_{out}= 0.04	Qn_{out}= 0.04
Heating & Cooling set points (°F)	72 & 75	72 & 75	72 & 75	72 & 75
# of bedrooms	3	3	3	3
Water heater size (gallons)	50	50	50	50
Water heater UEF (Electric)	0.93	0.93	0.93	0.93
Water heater UEF (Gas)	0.627	0.627	0.627	0.627
Water heater location	Garage	Garage	Garage	Garage
Water heater heat trap	No	Yes	No	Yes
High Efficacy Lighting (%)	100	90	100	90

All houses were modeled with wood frame walls. Since the 2021 IECC and 2020 FBC-EC both use the same wall reference *U*-factors, there should be no appreciable differences in results for mass walls.

After each Prescriptive minimum house was entered in EnergyGauge USA, annual simulations were run to estimate cooling, heating and water heating energy use. Table 2a shows the simulation results for the sample home with electric space and water heating in each of the three

modeled cities. Note that Table 2a results are *prior to* adding the required Section R408 efficiency options. Positive differences between the FBC-EC and IECC energy use values mean that the 2020 FBC-EC is less stringent than the 2021 IECC, while negative differences mean the FBC-EC is more stringent than the IECC.

Table 2a. Prescriptive Comparison Annual Energy Use Estimates with Electric Heating and Water Heating. IECC has electric resistance space heating in all climates whereas 2020 FBC-EC has heat pump in Tampa and Jacksonville. All 2021 IECC buildings are without any required efficiency packages.

CITY	Simulated Building	Cooling	Heating	Water Heating	Total	% of FBC-EC base
	Units	kWh/yr	kWh/yr	kWh/yr	kWh/yr	%
MIAMI	2020 FBC-EC	5678	328	1329.17	7335.2	
	2021 IECC	5461	294	1355.83	7110.8	
	Diff b/t FBC-EC & 2021 IECC	217	34	-26.7	224	3.1%
TAMPA	2020 FBC-EC	4156	546	1551.44	6253.4	
	2021 IECC	3902	1208	1580.45	6690.4	
	Diff b/t FBC-EC & 2021 IECC	254	-662	-29.0	-437	-7.0%
JACKSONVILLE	2020 FBC-EC	2853	1582	1793.6	6228.6	
	2021 IECC	2652	3494	1825.25	7971.3	
	Diff b/t FBC-EC & 2021 IECC	201	-1912	-31.7	-1742.7	-28.0%

Table 2a shows that for Prescriptive compliance, the 2020 FBC-EC is consistently somewhat less efficient for cooling than the 2021 IECC in all three cities as the 2021 IECC has stricter air exchange rates, and in CZ2, stricter ceiling insulation levels. However, the table shows that the 2020 FBC-EC uses less heat for electric heating in CZ2 as the IECC still allows electric resistance heating for all houses whereas the FBC-EC does not allow it for Prescriptive code compliance in Central and North Florida. The FBC-EC required water heating trap provides slight water heating energy savings relative to the IECC. All the prescriptive simulation runs for FBC-EC and IECC used the 2020 FBC-EC method of determining gallons per day of hot water use.

If the homes are heated with natural gas or other fossil fuel the efficiency requirement for space heating remains the same between the FBC-EC and IECC. In those cases the IECC Prescriptive combined cooling, heating and water heating energy use would be less than that of the FBC-EC as indicated in Table 2b. Table 2b results are again *prior to* adding the required Section R408 efficiency options.

Table 2b. Prescriptive Comparison Annual Energy Use Estimates with Natural Gas Heating and Water Heating. Space and water heating efficiency the same for IECC and FBC-EC gas systems. All 2021 IECC buildings are without any required efficiency packages.

CITY	Simulated Building	Cooling	Heating	Water Heating	Total	% of FBC-EC base
	Units	kWh/yr	Therms/yr	Therms/yr	MBtus/yr	
MIAMI	2020 FBC-EC	5754	14.7	75.46	28.654	
	2021 IECC	5571	13.2	78.792	28.213	
	Diff b/t FBC-EC & 2021 IECC	183	1.5	-3.3	0.44	1.5%
TAMPA	2020 FBC-EC	4274	63.2	86.73	29.58	
	2021 IECC	4030	54.1	90.258	28.19	
	Diff b/t FBC-EC & 2021 IECC	244	9.1	-3.5	1.39	4.7%
JACKSONVILLE	2020 FBC-EC	3007	85	98.98	28.661	
	2021 IECC	2826	74	102.802	27.325	
	Diff b/t FBC-EC & 2021 IECC	181	11	-3.8	1.3	4.7%

Required IECC 2021 Efficiency Packages

As discussed above, the Prescriptive IECC for 2021 goes beyond the simple envelope requirement table and list of mandatories by (stemming from ICC code change RE209-19) now including a Section R401.2.5 additional energy efficiency requirement, and allowing the builder to select the efficiency package from a list of options given in Section R408.2. Each of these options was added on individually to the 2021 IECC base Prescriptive simulations reported in Tables 2a and 2b and simulated for Tampa. Table 3 shows the results of these simulations which represent the 2021 IECC with additional efficiency packages vs. the 2020 FBC-EC.

Table 3. Section 408.2 additional efficiency package options – builders can choose any one for 2021 IECC Prescriptive compliance.

Tampa Single Story Prescriptive IECC includes parameters shown		Cooling (kWh/yr)	Heating	Wtr Htg	Space & WH Units	Total Mbtu	% of FBC base
R408.2.1 Enhanced Envelope Performance Option							
0.35 U windows and	2020 FBC	4156	546	1551	kWh/yr	21.3	
0.23 SHGC	2021 IECC	3827	1159	1580	kWh/yr	22.4	
	Dif b/t FEC &2021 IECC	329	-613	-29	kWh/yr	-1.1	-5.0%
R408.2.2 More Efficient HVAC Equipment Perf. Option							
a. SEER 16 AC and	2020 FBC	4274	63.2	87	Therms/yr	29.6	
95 AFUE Natural	2021 IECC	3607	45.6	90	Therms/yr	25.9	
Gas Furnace	Dif b/t FEC &2021 IECC	667	17.6	-4	Therms/yr	3.7	12.5%
b. SEER 16	2020 FBC	4156	546	1551	kWh/yr	21.3	
HSPF 10 Heat Pump	2021 IECC	3493	406	1580	kWh/yr	18.7	
	Dif b/t FEC &2021 IECC	663	140	-29	kWh/yr	2.6	12.4%
c. 3.5 COP Ground Source Heat Pump	Simulation not run						
R408.2.3 Reduced Energy Use in Service Water-Heating Option							
a. 82 EF Fossil Fuel	2020 FBC	4274	63.2	87	Therms/yr	29.6	
Water-Heating System	2021 IECC	4027	54.2	59	Therms/yr	25.1	
	Dif b/t FEC &2021 IECC	247	9	27	Therms/yr	4.5	15.1%
b. 2.0 EF Electric Water-Heating	2020 FBC	4156	546	1551	kWh/yr	21.3	
UEF 3.45 50 gallon heat pump	2021 IECC	3895	1212	622	kWh/yr	19.6	
water heater modeled for IECC	Dif b/t FEC &2021 IECC	261	-666	929	kWh/yr	1.8	8.4%
c. 0.4 Solar Fraction Water-Heating	2020 FBC	4156	546	1551	kWh/yr	21.3	
Closed loop, 29 square foot,	2021 IECC	3902	1209	44	kWh/yr	17.6	
solar system modeled	Dif b/t FEC &2021 IECC	254	-663	1507	kWh/yr	3.7	17.6%
R408.2.4 More Efficient Duct Thermal Distribution System Option							
a. 100% of Ducts and AH	2020 FBC	4156	546	1551	kWh/yr	21.3	
in Building Thermal Envelope	2021 IECC	3800	1197	1582	kWh/yr	22.5	
Modeled with R49 roof deck, unvente	Dif b/t FEC &2021 IECC	356	-651	-30	kWh/yr	-1.1	-5.2%
b. 100% of Ductless or	2020 FBC	4156	546	1551	kWh/yr	21.3	
Hydronic Thermal Dist. System	2021 IECC	3200	925	1580	kWh/yr	19.5	
in Building Thermal Envelope	Dif b/t FEC &2021 IECC	956	-379	-29	kWh/yr	1.9	8.8%
c. 100% of Duct System	2020 FBC	4156	546	1551	kWh/yr	21.3	
in Conditioned Space	2021 IECC	3290	949	1580	kWh/yr	19.9	
per Section R403.3.2	Dif b/t FEC &2021 IECC	866	-403	-29	kWh/yr	1.5	6.9%
R408.2.5 Improved Air Sealing and Efficient Ventilation System Option							
3 ach50 home with	2020 FBC	4156	546	1551	kWh/yr	21.3	
75% effective ERV	2021 IECC	4299	1241	1580	kWh/yr	24.3	
w. 1.2 cfm/W power	Dif b/t FEC &2021 IECC	-143	-695	-29	kWh/yr	-3.0	-13.9%

Table 4 provides the same Section R408.2 additional efficiency package options simulation runs as in Table 3 except in this case each option is compared with the FBC-EC "baseline" Prescriptive house to show the impact of just each individual change instead of showing the impact of the change together with the effect of other changes between the 2020 FBC-EC and 2021 IECC.

Table 4. Section 408.2 additional efficiency package options starting from FBC-EC Prescriptive house.

Tampa Single Story Prescriptive IECC includes parameters shown		Cooling (kWh/yr)	Heating	Wtr Htg	Space & WH Units	Total Mbtu	% of FBC base
R408.2.1 Enhanced Envelope Performance Option							
0.35 U windows and	2020 FBC	4156	546	1551	kWh/yr	21.3	
0.23 SHGC	w change	4077	526	1551	kWh/yr	21.0	
	Dif b/t FBC & change	79	20	0	kWh/yr	0.3	1.6%
R408.2.2 More Efficient HVAC Equipment Perf. Option							
a. SEER 16 AC and	2020 FBC	4274	63.2	87	Therms/yr	29.6	
95 AFUE Natural	w change	3825	53.2	87	Therms/yr	27.0	
Gas Furnace	Dif b/t FBC & change	449	10	0	Therms/yr	2.5	8.6%
b. SEER 16	2020 FBC	4156	546	1551	kWh/yr	21.3	
HSPF 10 Heat Pump	w change	3720	469	1551	kWh/yr	19.6	
	Dif b/t FBC & change	436	77	0	kWh/yr	1.8	8.2%
c. 3.5 COP Ground Source Heat Pump	Simulation not run						
R408.2.3 Reduced Energy Use in Service Water-Heating Option							
a. 82 EF Fossil Fuel	2020 FBC	4274	63.2	87	Therms/yr	29.6	
Water-Heating System	w change	4272	63.3	60	Therms/yr	26.9	
	Dif b/t FBC & change	2	-0.1	27	Therms/yr	2.7	9.1%
b. 2.0 EF Electric Water-Heating	2020 FBC	4156	546	1551	kWh/yr	21.3	
UEF 3.45 50 gallon heat pump	w change	4149	547	593	kWh/yr	18.1	
water heater modeled for IECC	Dif b/t FBC & change	7	-1	959	kWh/yr	3.3	15.4%
c. 0.4 Solar Fraction Water-Heating	2020 FBC	4156	546	1551	kWh/yr	21.3	
Closed loop, 29 square foot,	w change	4156	546	36	kWh/yr	16.2	
solar system modeled	Dif b/t FBC & change	0	0	1515	kWh/yr	5.2	24.2%
R408.2.4 More Efficient Duct Thermal Distribution System Option							
a. 100% of Ducts and AH	2020 FBC	4156	546	1551	kWh/yr	21.3	
in Building Thermal Envelope	w change	4058	523	1553	kWh/yr	20.9	
Modeled with R38 roof deck, unvente	Dif b/t FBC & change	98	23	-1	kWh/yr	0.4	1.9%
b. 100% of Ductless or	2020 FBC	4156	546	1551	kWh/yr	21.3	
Hydronic Thermal Dist. System	w change	3457	417	1551	kWh/yr	18.5	
in Building Thermal Envelope	Dif b/t FBC & change	699	129	0	kWh/yr	2.8	13.2%
c. 100% of Duct System	2020 FBC	4156	546	1551	kWh/yr	21.3	
in Conditioned Space	w change	3545	426	1551	kWh/yr	18.8	
per Section R403.3.2	Dif b/t FBC & change	611	120	0	kWh/yr	2.5	11.7%
R408.2.5 Improved Air Sealing and Efficient Ventilation System Option							
3 ach50 home with	2020 FBC	4156	546	1551	kWh/yr	21.3	
75% effective ERV	w change	4404	527	1551	kWh/yr	22.1	
w. 1.2 cfm/W power	Dif b/t FBC & change	-248	19	0	kWh/yr	-0.8	-3.7%

The Table 3 2021 IECC with option package energy savings relative to the 2020 FBC-EC in Tampa range from -14% to over 15%. The Section R408.2.1 option may be a popular one for those already complying by the prescriptive method. It requires an overall UA value of 0.95 of the required minimum and 0.95 of the required SHGC. For the 2,000 square foot home modeled we found using windows with a *U*-factor of 0.35 and SHGC of 0.23, instead of the maximum *U*-factor of 0.4 and SHGC of 0.25, brought the home into compliance. Many windows are sold in Florida meeting those criteria. Because the geometry and components of the home impacts the

UA, the required change will vary slightly with each home. Unfortunately, this simple envelope upgrade does not reduce the energy use as much as many of the other Section R408.2 options.

Another popular additional efficiency option may be an improved water heater as provided in Section R408.2.3. Changing from the natural gas baseline to a tankless gas water heater allows compliance and reduces the water heating estimated energy use by 27 Therms. Another option is to install a heat pump water heater instead of electric resistance. Although the federal minimum requires heat pump water heaters when units have capacity greater than 55-gallons, most homes are installed with 50-gallon or smaller units. Savings estimated from a 50-gallon heat pump water heater were 959 kWh/yr. The IECC only requires an EF of 2.0, but FSEC simulated a 3.45 UEF heat pump water heater as 3.45 and higher UEFs appear to be what are more typically sold. Another option would be a solar thermal system. Although the IECC requirement is only 0.4 solar fraction, FSEC simulated a more typical single panel closed loop active system with a PV powered pump. It handled all but 44 kWh of the water heating load.

Efficiency package options in Section R408.2.2 require improved efficiency of cooling and heating equipment and options in Section R408.2.4 are about placing thermal distribution systems inside the building thermal envelope or conditioned space. Each of these save significant energy and are options for builders to consider.

The Section R408.2.5 efficiency package option requires a tighter envelope and a high efficiency mechanical ventilation heat or energy recovery unit. Because infiltration of air is not a large penalty in Florida homes relative to more northern homes, this option does not readily save energy relative to the 2020 FBC-EC. The IECC R408.2.5 home was simulated with 3 ach50 and an enthalpy recovery ventilator of 75% with 60 cfm of supply and exhaust and 1.2 cfm/Watt (50 watts continuous). The FBC-EC base home has air leakage of 7 ach50 and no mechanical ventilation system.

If the additional efficiency requirements are adopted in Florida, the Prescriptive methods will require another compliance feature to be built, verified and inspected as the builder will have to indicate which Section R408.2 option they are using. Software such as EnergyGauge USA and RES*check* will need to add capabilities/outputs for prescriptive compliance. Estimating if the 8th edition of the FBC-EC will comply with the 2021 IECC becomes slightly more difficult as ideally one would estimate what percentage of builders are using which additional efficiency measure to comply.

Individual Code Changes

There are also a number of changes between these two codes that may apply to a very limited number of projects as opposed to the majority or typical project. It can also be useful to individually analyze some of the more widely required changes. A number of these changes that are impactful are either discussed or analyzed via individual simulations below. To determine the value of the modification via simulation, a single change was made to the base all-electric 2021 IECC Tampa single family 2,000 sq. ft., 1-story, Prescriptive house and simulated.

Individual Code Change #1: 2018 to 2021 ICC code change RE33-19 increased the 2021 IECC Prescriptive Climate Zone 2 minimum ceiling insulation requirement from R-38 to R-49. The

impact of that change alone for the single story Tampa house as shown in Table 5 is 76 kWh of annual energy savings.

Table 5. Individual Code Change #1: R-38 to R-49 ceilings.

Climate Zone 2 R49 Ceiling Tampa Single Story 2000 ft^2 home	Cooling (kWh/yr)	Heating	Wtr Htg	Space & WH Units	Total Mbtu	% of FBC base
Base FBC R 38 Ceiling Insulation	4156	546	1551	kWh/yr	21.3	
R49 Ceiling Insulation	4108	518	1551	kWh/yr	21.1	
Dif b/t base & code change	48	28	0	kWh/yr	0.3	1.2%

Summary: About 1 % savings possible, should examine cost/benefit analysis.

Individual Code Change #2: 2018 to 2021 ICC code change RE44-19 adds baffle installation language to mandatory Section R402.2.3 Eave Baffle to maximize space for attic insulation coverage and prevent ventilation air bypass. This change was modeled with a Tampa base code efficiency R-38 vented attic project by changing the *R*-value and area of the insulation over the eave as shown in Table 6.

Simulation results are shown in Table 6. The combined heating and cooling difference in Tampa is 27 kWh/yr.

Table 6. Individual Code Change #2: Mandatory eave baffles.

R402.2.3 mandatory baffle Tampa Single Story 2000 ft^2 home	Cooling (kWh/yr)	Heating	Wtr Htg	Space & WH Units	Total Mbtu	% of FBC base
R38 1525 ft^2 and R16.3 for 475 ft^2	4214	581	1552	kWh/yr	21.7	
R38 1561 ft^2 and R18.8 for 439 ft^2	4197	571	1552	kWh/yr	21.6	
Dif b/t base & code change	17	10	0	kWh/yr	0.1	0.4%

Summary: About 0.4 % savings possible, change represents best practice, should examine cost/benefit analysis.

Individual Code Change #3: 2018 to 2021 ICC code change RE47-19 provides Section R402.2.4 insulation level exceptions in Climate Zones 0 through 4 for horizontal pull-down stair type access hatches that provide access from conditioned space to unconditioned space. This change was modeled by comparing an R-38 vented attic project with the same project that had 8 square feet of R-13 attic insulation to represent the attic access hatch exception.

Simulation results are shown in Table 7. This small amount of attic space exception results in 1 kWh of additional cooling.

Table 7. Individual Code Change #3: R-38 vented attic vs. R-38 vented attic with 8 sq. ft. at R-13.

R402.2.4 exception for attic hatch Tampa Single Story 2000 ft^2 home	Cooling (kWh/yr)	Heating	Wtr Htg	Space & WH Units	Total Mbtu	% of FBC base
Base FBC	4156	546	1551	kWh/yr	21.3	
R38 1992 ft^2 and R13 for 8 ft^2	4157	546	1551	kWh/yr	21.3	
Dif b/t base & code change	-1	0	0	kWh/yr	0.0	0.0%

Summary: Practical exception without any real energy cost –recommend approval of exception.

Individual Code Change #4: 2018 to 2021 ICC code change RE49-19 reorganizes attic hatch and door requirements creating new Section R402.2.4.1 which expands requirements regarding retaining attic insulation to include "from higher to lower sections of the attic and from attics covering conditioned spaces to unconditioned spaces." This is a clarification and represents best current practice and thus was not simulated. ***Summary: Clarifying language to assure installations are as intended. Recommend approval.***

Individual Code Change #5: 2018 to 2021 ICC code change RE88-19 adds an alternative air leakage limit for attached single and multifamily building dwelling units and buildings or dwelling units that are 1,500 square feet or smaller. Instead of the standard IECC requirement of 5 ACH50, these homes can comply with leakage rates of 0.30 cfm/sq. ft. of dwelling unit enclosure area tested at 50 Pascals. This requirement would still be slightly more stringent than Florida's 7 ACH50 limit.
Summary: Unless FBC-EC is changing their air leakage limit, no benefit from change. Not recommended.

Individual Code Change #6: 2018 to 2021 ICC code change RE111-19 changes Section R403.3.1 from Prescriptive to Mandatory, so combined with RE109-19, in part means ducts 3 inches in diameter and larger that are located outside of conditioned space must be insulated to R-8 for all compliance options, versus the 2018 IECC which only required prescriptive compliance attic ducts 3 inches in diameter and larger in attics to be insulated to R-8. However, the 2020 FBC-EC already requires R-8 for attic ductwork for Prescriptive compliance and the Performance (Section R405) standard reference design in the 2020 FBC-EC models ductwork with a DSE in the thermal envelope, so there should be no estimated energy use change for most homes which either have ductwork in the conditioned space or in attics. Very small energy savings may be expected in homes with ductwork running in crawlspaces or basements if this change is adopted in Florida. ***Summary: Neutral. Would rarely impact a Florida home and then only slightly impact energy use.***

Individual Code Change #7: 2018 to 2021 ICC code change RE109-19 clarifies existing Section R403.3.2 option that allows ductwork to be considered as being inside conditioned space, and adds two new options-- for ductwork in floor cavities and within exterior walls. For ductwork to truly behave as being in conditioned space requires an effective air barrier on the exterior wall and floors over unconditioned space. Without specific testing of these spaces it is

questionable that these locations will consistently behave like ducts in fully conditioned space. ***Summary: Not recommended as unlikely spaces will behave as proponent intends.***

Individual Code Change #8: 2018 to 2021 ICC code change RE118-19 clarifies the types of ducts noted in the Section R403.3.5 exception that are not required to have tested ducts:

From 2018 IECC

> **[Exception 2:]** A duct air-leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems.

From 2021 IECC (changed text underlined)

> **Exception:** A duct air-leakage test shall not be required for ducts serving <u>heating, cooling, or ventilation systems</u> that are not integrated with ducts serving heating or cooling systems.

Regarding the language change from "energy recovery ventilators" to "ventilation systems", this change would tend to decrease stringency by including additional ventilation system types in the exception. The FBC-EC does not however currently include any ventilation system duct testing exception language, so stringency and cost impacts depend on understanding of FBC-EC not including this exception. It is not however clear to the authors how adding heating and cooling systems are to be understood here, so it is not possible to assess impacts from these changes. ***Summary: Not recommended with current language.***

Individual Code Change #9: 2018 to 2021 ICC code change RE112-19 adds a Prescriptive compliance total duct leakage limit of 8 cfm/100 sq. ft. at 25 Pascal test pressure to Section R403.3.6 for cases in which all ducts and air handlers are located entirely within the building thermal envelope. The 2020 FBC-EC does not require testing for Prescriptive projects in which all ducts and air handlers are within the thermal envelope, so this change would require testing in all of these cases and would likely require additional duct sealing in some cases. ***Summary: Recommended. Would assure HVAC system was not going to cause issues by having undue leakage to inside or outside.***

Individual Code Change #10: 2018 to 2021 ICC code change RE134-19 removes the efficacy exception for air handlers that are integral to HVAC equipment used to provide whole-house mechanical ventilation and adds efficacy requirement to Table R403.6.2 for air handlers that are integral to HVAC equipment used to provide whole-house mechanical ventilation. The 2018 IECC had only required electronically commutated motors for such air handlers while the 2021 IECC requires them to have a minimum efficacy of 1.2 cfm/watt. ECM motors likely have overall efficacies of 1.2 cfm/watt or greater, so it is not expected that this change would have an energy effect. However, the meaning of the change is not perfectly clear as the change could be referring to efficiency when bringing in outside air. Some builders use central fan integrated systems to ventilate homes where the fan circulates air at 350 to 400 cfm per ton but is only pulling in 50 to 100 cfm from outside. It is not clear if this provision makes such fans a code violation and the FBC-EC should make any such adoption clear as to the intent. ***Summary: Not recommended with current language.***

Individual Code Change #11: 2018 to 2021 ICC code change RE130-19 creates new Section R403.6.3 that requires that mechanical ventilation systems be tested and verified to provide the minimum ventilation flow rates required by Section R403.6, with an exception for certain kitchen range hoods. Where required by the code official, the testing must be conducted by an approved third party.

This change would increase compliance costs slightly in applicable cases. While verification of minimum mechanical ventilation flow rates is seen by the authors as an appropriate and even needed step (see FBC sponsored ventilation study[1]), this is not something to be modeled for energy, but rather an outdoor air ventilation requirement. ***Summary: Recommended based on issues found with installed systems in previous research projects.***

Individual Code Change #12: 2018 to 2021 ICC code change RE145-19 changes permanent lighting high efficacy requirement in Section R404.1 from 90% of lighting to all lighting. This change has almost no compliance cost due to the low price of high efficacy lighting. Stringency impact was simulated comparing the baseline efficiency FBC-EC Tampa Prescriptive project with 90% high efficacy lighting to the same project with 100% high efficacy lighting. More efficient lighting reduces internal heat generation which will increase space heating needs but decrease space cooling needs.

Simulation results are shown in Table 8. The combined heating, cooling and lighting difference in Tampa is estimated at 195 kWh/yr.

Table 8. Individual Code Change #12. 90% high efficacy lighting vs. 100% high efficacy lighting.

R404.1 100% High efficacy lighting Tampa Single Story 2000 ft^2 home	Cooling (kWh/yr)	Heating (kWh/yr)	Lighting (kWH/yr)	Total H,C & L	% of FBC H,C & L
Base FBC 90% HE lighting	4156	546	953	5655	
100% HE Lighting	4128	552	780	5460	
Dif b/t base & code change	28	-6	173	195.0	3.4%

Summary: Saves on lighting and cooling. Apply cost effectiveness.

Individual Code Change #13: 2018 to 2021 ICC code change RE145-19 creates mandatory new Section R404.2 Interior Lighting Controls which, with exceptions for bathrooms, hallways, exterior and safety lighting, requires either a dimmer, occupant sensor or other control built into the fixture for permanently installed lighting fixtures. Proponent did not provide economic analysis. If we were to assume this code change saved 10% of the base interior lighting load of 855 kWh/yr that would represent 85.5 kWh per year of saving. We would expect about a 3 kWh proportional reduction in cooling energy use and perhaps a 0.5 kWh increase in heating for a total savings of around 88 kWh/year. ***Summary: Saves on lighting and cooling. Apply cost effectiveness.***

[1] https://publications.energyresearch.ucf.edu/wp-content/uploads/2018/06/FSEC-CR-2002-15.pdf

Individual Code Change #14: 2018 to 2021 ICC code change RE149-19 creates new Prescriptive Section R404.3 Exterior Lighting Controls that requires specified automatic shut off controls where total permanent installed exterior lighting power is greater than 30 watts.

A 2014 report by the Consortium on Energy Efficiency noted by the RE149-19 proponent estimates average daily exterior lighting on hours of 2.6 hours per day and on hour reductions of 20% for photocells and 50% for timers, while also stating that significant refinement work is still necessary.[2] RESNET methodology would indicate 65 kWh per year are used for exterior lighting on a home with 90% high efficacy fixtures. If we apply an average 35% savings to that, this measure would save 22.75 kWh per year. ***Summary: Saves on lighting energy use. Apply cost effectiveness.***

Individual Code Change #15: 2018 to 2021 ICC code change RE151-19 to Section R405.2 Performance-Based Compliance requires Performance compliance project envelope efficiency to meet or exceed residential 2009 IECC Table 402.1.1 or Table 402.1.3.

While these minimum envelope efficiency values are largely more stringent than what the 2020 FBC-EC allows for Performance compliance, for frame wall projects there should be little impact. For block walls however, this change would require R-6 in Climate Zone 2 when more than half of the insulation is on the interior of the mass wall, which the authors believe is a higher *R*-value than what is typically installed. Alternatively, a wall with a *U*-factor of 0.14 for Climate Zone 2 could be used which would still be slightly stricter than typical practice. Since the performance method trades off one energy feature for another there would be no change in expected energy use for a home meeting the minimum performance compliance with or without this change. There may be some persistence of the energy savings though since insulation may last for 50 years where current equipment trade-offs do not last that long. ***Summary: No short term energy impact – resistance from concrete block industry to be expected.***

Individual Code Change #16: 2018 to 2021 ICC code change RE209-19 in part provides two Section R401.2.5 additional Section R405 Performance energy efficiency options. One of these options is to include one of the Section R408.2 efficiency packages in Performance compliance projects—this option is discussed in the Performance compliance section of this report. The other option is for the proposed design have an annual energy cost that is less than or equal to 95 percent of the annual energy cost of the standard reference design. The parallel FBC-EC Performance criteria to "energy cost" is "total loads" with an e-Ratio of 1.0 representing a project that just meets the code; so for Florida compliance, meeting this option's requirement would mean an e-Ratio of 0.95.

To simulate this option, a 2,000 sq. ft. single story Tampa FBC-EC house with an e-Ratio of 1.0 was compared with the same house with an e-Ratio of 0.95. The e-ratio reduction was achieved by changing from a SEER 14 / HSPF 8.2 heat pump to a SEER 15 / HSPF 9.0 heat pump.

Simulation results are shown in Table 9. The combined heating and cooling difference in Tampa is estimated at 265 kWh/yr.

[2] https://library.cee1.org/system/files/library/11458/CEE_LightingMarketCharacterization.pdf

Table 9. Individual Code Change #16. 1.0 Performance e-Ratio vs. 0.95 e-Ratio.

	Heating (kWh/yr)	Cooling (kWh/yr)	Wtr Htg (kWh/yr)	Total (kWh/yr)	% of 1.0 e-Ratio
e-Ratio 1.0 (14.0/8.2 HP)	547	4032	1945	6524	
e-Ratio 0.95 (15.0/9.0 HP)	507	3807	1945	6259	
Diff. e-Ratio 1.0 to 0.95	40	225	0	265	4.1%

Summary: Optional how builders achieve 0.95 e-Ratio. Would make Florida homes more efficient. Recommended.

Individual Code Change #17: 2018 to 2021 ICC code change RE192-19 reduces the Table R406.5 maximum Energy Rating Index (ERI) for all Climate Zones. This change reduces the maximum IECC Climate Zones 1 and 2 ERI from 57 to 52, and if adopted in Florida would reduce the maximum FBC-EC ERI from 58 to 52. Simulation results comparing an ERI of 57 with an ERI of 52 (reduced via slightly higher efficiency heat pump and heat pump water heater) are shown in Table 10. The combined heating, cooling and water heating difference in Tampa is 1,352 kWh/yr. Table 11 shows the same comparison but adds the 2021 IECC Section R401.2.5 additional ERI efficiency provision that requires the Index be 5% less than the Table R406.5 specified Index value, with combined energy use savings of 1,842 kWh/yr.

Table 10. Individual Code Change #17. Energy Rating Index = 57 to 52.

Table R406.5 Max. Energy Rating Index reduction	Cooling (kWh/yr)	Heating (kWh/yr)	Wtr Htg (kWh/yr)	Space & WH Units	Total Mbtu	% of Base
ERI 57 (15.0/9.0 HP)	3538	466	1946	kWh/yr	20.3	
ERI 52 (15.5/9.5 HP, HPWH)	3438	450	710	kWh/yr	15.7	
Diff. ERI 57 - 52	100	16	1236	kWh/yr	4.6	22.7%

Table 11. Individual Code Change #17. Energy Rating Index = 57 to 49.

Table R406.5 Max. Energy Rating Index reduction + effic. option	Cooling (kWh/yr)	Wtr Htg (kWh/yr)	Heating (kWh/yr)	Space & WH Units	Total Mbtu	% of Base
ERI 57 (15.0/9.0 HP)	3538	1946	466	kWh/yr	20.3	
ERI 49 (52 - 5% per R401.2.5)*	3009	709	390	kWh/yr	14.0	
Diff. ERI 57 - 49	529	1237	76	kWh/yr	6.3	31.0%

* ERI 49 project has a ductless 15 SEER / 9.0 HSPF HP and HPWH

Summary: Saves energy although ERI method at index of 57 is usually more stringent than R405 and Prescriptive methods. Apply cost effectiveness.

Individual Code Change #18: 2018 to 2021 ICC code change RE218-19 reduces the Section R503.1.4 lighting efficacy exception from alterations that replace less than 50 percent of the luminaires to those replacing less than 10 percent of the luminaires. This change was simulated by assuming that 20% of luminaires in those homes are already high efficacy and that there would now be 90% high efficacy lamps.

Simulation results are shown in Table 12. The combined heating, cooling and lighting difference in Tampa is 1,339 kWh/yr.

Table 12. Individual Code Change #18. 90% high efficacy lighting for alterations.

R503.1.4 High efficacy lighting for alterations	Cooling	Heating	Lighting	Total	% of FBC
Tampa Single Story 2000 ft^2 home	(kWh/yr)	kWh/yr)	(kWH/yr)	H,C & L	H,C & L
Assume 20% HE lighting before alteration	4342	492	2160	6994	
90% HE Lighting	4156	546	953	5655	
Dif b/t base & code change	186	-54	1207	1339.0	19.1%

Summary: Saves significant energy. Apply cost effectiveness.

Performance Compliance Simulations

The Performance compliance stringency comparison includes four sample homes: one (1) 1-story single family home, one (1) 2-story single-family home, one (1) multi-family home, and one (1) additional home with skylights. Performance comparisons were made in the same three cities as the Prescriptive comparisons: Miami, Tampa and Jacksonville. These houses vary from the ones used for the Prescriptive compliance comparison in that instead of using Prescriptive minimum component and equipment efficiencies, they use "reference" component and equipment efficiencies (discussed further below).

Then as discussed above for Prescriptive compliance, stemming from ICC code change RE209-19, new Section R401.2.5 in the 2021 IECC requires an additional efficiency package for all Chapter 4 projects. In the case of Performance compliance, it allows either one of the Section R408.2 additional efficiency package options or for the proposed design have an annual energy cost that is less than or equal to 95 percent of the annual energy cost of the standard reference design. The parallel FBC-EC Performance criteria to "energy cost" is "total loads" with an e-Ratio of 1.0 representing a project that just meets the code; so for Florida compliance, meeting this option's requirement would mean an e-Ratio of 0.95. See Individual Code Change #16 above for additional discussion of the 95 percent option.

Performance simulations were made with and without an additional efficiency package. The ≥ 2.0 EF electric service water-heating system package option (from Section R408.2.3) was selected for the Performance simulations that include the additional efficiency package. A 3.45 UEF HPWH was used for the simulation (instead of 2.0 EF) as 3.45 and higher UEFs appear to be what are more typically sold.

Per Section R405.2, 2021 IECC Performance compliance also requires the building thermal envelope to meet or exceed the levels of efficiency and solar heat gain coefficients in Table 402.1.1 or 402.1.3 of the 2009 IECC. To meet this requirement, the IECC frame wall *U*-factors were set to 0.082 (compared with 0.084 for the FBC-EC houses). No other changes to the IECC houses were required to meet this code change.

Performance house characteristics are shown in Table 13.

Table 13. Performance Comparison House Characteristics. Red type indicates more stringent parameter.

Component	Climate Zone 1		Climate Zone 2	
	2021 IECC	**2020 FBC-EC**	**2021 IECC**	**2020 FBC-EC**
Conditioned floor area (ft^2) (one story / two story / multi)	2,000 / 2,400 / 1,200	2,000 / 2,400 / 1.200	2,000 / 2,400 / 1,200	2,000 / 2,400 / 1,200
Foundation type	SOG	SOG	SOG	SOG
Floor perimeter R-value	0	0	0	0
Wall type	Wood Frame	Wood Frame	Wood Frame	Wood Frame
Wall framing fraction	0.230	0.230	0.230	0.230
Wall *U*-factor	0.082	0.084	0.082	0.084
Wall solar absorptance	0.75	0.75	0.75	0.75
Common Wall Area (multi-family only)	720	720	720	720
Window area (ft^2) (one story / two story / multi)	300 / 360 / 72	300 / 360 / 72	300 / 360 / 72	300 / 360 / 72
Skylight area (ft^2) (skylight home only)*	0	22	0	22
Window U-factor	0.5	0.5	0.4	0.4
Window SHGC	0.25	0.25	0.25	0.25
Roofing material	Comp. Shingles	Comp. Shingles	Comp. Shingles	Comp. Shingles
Roof solar absorptance	0.75	0.75	0.75	0.75
Attic ventilation	Vented 1/300	Vented 1/300	Vented 1/300	Vented 1/300
Ceiling framing fraction	0.110	0.110	0.110	0.110
Ceiling *U*-factor	0.035	0.035	0.026	0.030
Envelope ACH50 (air chng/hr @ 50pa)	5.0	7	5.0	7
HP SEER / HSPF	14 / 8.2	14 / 8.2	14 / 8.2	14 / 8.2
AHU location	Garage	Conditioned space	Garage	Conditioned space
Duct insul. R-value (Supply / Return)	8 / 8	6 / 6	8 / 8	6 / 6
Duct location	Attic	Conditioned space	Attic	Conditioned space
Duct leakage	Qn_{out}= 0.04	DSE = 0.88	Qn_{out}= 0.04	DSE = 0.88
Heating / Cooling set points (°F)	72 / 75	72 / 75	72 / 75	72 / 75
# of bedrooms (one story / two story / multi)	3 / 4 / 2	3 / 4 / 2	3 / 4 / 2	3 / 4 / 2
Water heater size (gallons)	50	50	50	50
Hot water use: 3 bdrm. / 4 / 2 bdrm. (gal/day)**	40.6 / 48.5 / 32.5	40.6 / 48.5 / 32.5	Tampa: 42.9 / 51.2 / 34.3 Jax: 45.0 / 53.7 / 36.0	Tampa: 42.9 / 51.2 / 34.3 Jax: 45.0 / 53.7 / 36.0
Water heater UEF (Elect)***	0.93 and 3.45	0.93	0.93 and 3.45	0.93
Water heater location (1 and 2 story / multi)	Garage / Cond. space	Garage / Cond. space	Garage / Cond. space	Garage / Cond. space

Water heater heat trap	No	Yes	No	Yes
High Efficacy Lighting	100%	90%	100%	90%

* The 2020 FBC-EC skylight house is the one story single family home with 22 square feet of 0.75 (CZ 1) or 0.65 (CZ 2) U-factor and 0.25 SHGC skylight added (no skylight area was added to the 2018 IECC one story house for this comparison as the 2021 IECC reference has no skylight area).

** While the 2021 IECC reference hot water use is higher than that of the 2020 FBC-EC reference house, the 2020 FBC-EC values were used for both FBC-EC and IECC simulations so what is really a non-stringency difference does not affect results.

*** As discussed above, 2021 IECC heat pump water heater Performance simulations were included to address the Section R401.2.5 additional efficiency package requirement.

All houses were again modeled with wood frame walls. Since the 2021 IECC and 2020 FBC-EC both use the same wall reference *U*-factors, there should be no appreciable differences in results for mass walls.

After each house was entered in EnergyGauge USA, annual simulations were run to estimate cooling, heating and water heating energy use for the reference 2021 IECC house and reference 2020 FBC-EC house. The reference house is a house that has the same conditioned floor, wall and ceiling areas as a proposed project house, but with other characteristics such as window area and efficiency levels stipulated by the code's rule set.[3] Since the total annual energy costs (IECC) or annual loads (FBC-EC) of a reference house represent the minimum Performance code level, using the reference house for these simulations provides a comparison of each code's minimum Performance compliance efficiency.

In the 2018 IECC the reference duct and air handler locations were not stipulated. In the 2021 IECC the reference duct location is stipulated as being the same as the proposed design. Since the IECC allows tested ducts in unconditioned space and most duct systems in Florida are installed in unconditioned attics,[4] for IECC simulations, tested duct systems were modeled in an unconditioned attic with air handlers in the garage (except for the multi-family units, for which the air handlers were in the main conditioned space). Multi-family units were top floor units with attic space directly above, but surrounded on two sides and below with conditioned neighbor units.

Table 14 shows the estimated space heating, cooling, water heating and total energy use for the 2,000 sq. ft. one story house in each of the three modeled cities. The 2021 IECC results include energy use for both houses with and without the additional efficiency package required per Section R401.2.5 (with a UEF 3.45 HPWH selected for the efficiency package houses). Table 15 shows the same results for the 2,400 sq. ft. two story house, and Table 16 for the multi-family house. Positive differences between the FBC-EC and IECC energy use values again mean that the 2020 FBC-EC is less stringent than the 2021 IECC while negative differences mean the FB-EC is more stringent than the IECC.

[3] See Section R405 and Table R405.4.2(1) of the 2021 IECC and Section R405 and Table R405.5.2(1) of the 2020 FBC-EC for more information on reference houses.

[4] A 2013 code compliance form analysis report by the University of Florida (Issa 2013) found sampled 2010 - 2012 homes to have less than 15% of supply ducts in conditioned space; around 30% of return ducts were found to be in conditioned space for the same three years. A 2012 FSEC code compliance study (Withers et al. 2012) found 96.8% of sampled new Florida homes to have supply ducts in the attic.

Table 14. One story house Performance comparison annual energy use estimates.

City		Heating (kWh/yr)	Cooling (kWh/yr)	Wtr Htg (kWh/yr)	Total (kWh/yr)	% of FBC
Miami	2020 FBC-EC	101	5276	1690	7067	
	2021 IECC w/o Eff Pkg	104	5403	1721	7228	
	2021 IECC w/ WH Pkg	105	5396	649	6150	
	Diff. FBC- IECC w/o Eff Pkg	-3	-127	-31	-161	-2.3%
	Diff. FBC- IECC w/ WH Pkg	-4	-120	1041	917	13.0%
Tampa	2020 FBC-EC	514	3875	1945	6334	
	2021 IECC w/o Eff Pkg	519	3956	1978	6453	
	2021 IECC w/ WH Pkg	521	3950	742	5213	
	Diff. FBC- IECC w/o Eff Pkg	-5	-81	-33	-119	-1.9%
	Diff. FBC- IECC w/ WH Pkg	-7	-75	1203	1121	17.7%
Jacksonville	2020 FBC-EC	1445	2730	2218	6393	
	2021 IECC w/o Eff Pkg	1482	2751	2254	6487	
	2021 IECC w/ WH Pkg	1485	2745	847	5077	
	Diff. FBC- IECC w/o Eff Pkg	-37	-21	-36	-94	-1.5%
	Diff. FBC- IECC w/ WH Pkg	-40	-15	1371	1316	20.6%

Table 15. Two story house Performance comparison annual energy use estimates.

City		Heating (kWh/yr)	Cooling (kWh/yr)	Wtr Htg (kWh/yr)	Total (kWh/yr)	% of FBC
Miami	2020 FBC-EC	143	6355	1993	8491	
	2021 IECC w/o Eff Pkg	148	6445	2025	8618	
	2021 IECC w/ WH Pkg	148	6433	707	7288	
	Diff. FBC- IECC w/o Eff Pkg	-5	-90	-32	-127	-1.5%
	Diff. FBC- IECC w/ WH Pkg	-5	-78	1286	1203	14.2%
Tampa	2020 FBC-EC	661	4822	2294	7777	
	2021 IECC w/o Eff Pkg	677	4955	2328	7960	
	2021 IECC w/ WH Pkg	678	4945	812	6435	
	Diff. FBC- IECC w/o Eff Pkg	-16	-133	-34	-183	-2.4%
	Diff. FBC- IECC w/ WH Pkg	-17	-123	1482	1342	17.3%
Jacksonville	2020 FBC-EC	1709	3519	2618	7846	
	2021 IECC w/o Eff Pkg	1789	3577	2653	8019	
	2021 IECC w/ WH Pkg	1794	3569	930	6293	
	Diff. FBC- IECC w/o Eff Pkg	-80	-58	-35	-173	-2.2%
	Diff. FBC- IECC w/ WH Pkg	-85	-50	1688	1553	19.8%

Table 16. Multi-family Performance comparison annual energy use estimates.

City		Heating (kWh/yr)	Cooling (kWh/yr)	Wtr Htg (kWh/yr)	Total (kWh/yr)	% of FBC
Miami	2020 FBC-EC	39	2907	1387	4333	
	2021 IECC w/o Eff Pkg	40	3108	1419	4567	
	2021 IECC w/ WH Pkg	55	2744	609	3408	
	Diff. FBC- IECC w/o Eff Pkg	-1	-201	-32	-234	-5.4%
	Diff. FBC- IECC w/ WH Pkg	-16	163	778	925	21.3%
Tampa	2020 FBC-EC	159	2364	1583	4106	
	2021 IECC w/o Eff Pkg	162	2529	1616	4307	
	2021 IECC w/ WH Pkg	217	2208	664	3089	
	Diff. FBC- IECC w/o Eff Pkg	-3	-165	-33	-201	-4.9%
	Diff. FBC- IECC w/ WH Pkg	-58	156	919	1017	24.8%
Jacksonville	2020 FBC-EC	388	1862	1794	4044	
	2021 IECC w/o Eff Pkg	396	1995	1827	4218	
	2021 IECC w/ WH Pkg	526	1706	727	2959	
	Diff. FBC- IECC w/o Eff Pkg	-8	-133	-33	-174	-4.3%
	Diff. FBC- IECC w/ WH Pkg	-138	156	1067	1085	26.8%

Tables 14-16 show that overall, 2020 FBC-EC energy use is slightly lower than 2021 IECC energy use when the 2021 IECC sample houses are simulated *without* the now required additional efficiency package, with differences ranging from 1.5% to 5.4%. This is in large part due to the IECC houses being simulated with attic ductwork[5] and the IECC not requiring a storage water heater heat trap while the FBC-EC does require the heat trap. However, when the 2021 IECC sample houses are simulated with a required additional efficiency package (in this case via a 3.45 UEF HPWH to represent the reduced service water heating package option), they use from 13.0% to 26.8% less energy than the 2020 FBC-EC houses.

Table 17 shows the estimated space heating, cooling, water heating and total energy use for the 2,000 sq. ft. one story house skylight simulations. For these runs, since the 2020 FBC-EC reference includes skylight area for houses with proposed skylights but the 2021 IECC does not, the FBC-EC houses include 22 sq. ft. of skylights (representing the reference area for 3x 2 ft. by 4 ft. proposed skylights) and the 2021 IECC houses do not include skylight area (so IECC energy use is the same as in Table 14 above). Positive differences between the FBC-EC and IECC energy use values again mean that the 2020 FBC-EC is less stringent than the 2021 IECC while negative differences mean the FBC-EC is more stringent than the IECC.

[5] As discussed above, the 2021 IECC is simulated with attic ducts since the reference duct location is now the same as the proposed design, which in Florida is most commonly the attic.

Table 17. Skylight Performance comparison annual energy use estimates.

City		Heating (kWh/yr)	Cooling (kWh/yr)	Wtr Htg (kWh/yr)	Total (kWh/yr)	% of FBC
Miami	2020 FBC-EC	106	5400	1690	7196	
	2021 IECC w/o Eff Pkg	104	5403	1721	7228	
	2021 IECC w/ WH Pkg	105	5396	649	6150	
	Diff. FBC- IECC w/o Eff Pkg	2	-3	-31	-32	-0.4%
	Diff. FBC- IECC w/ WH Pkg	1	4	1041	1046	14.5%
Tampa	2020 FBC-EC	540	4015	1945	6500	
	2021 IECC w/o Eff Pkg	519	3956	1978	6453	
	2021 IECC w/ WH Pkg	521	3950	742	5213	
	Diff. FBC- IECC w/o Eff Pkg	21	59	-33	47	0.7%
	Diff. FBC- IECC w/ WH Pkg	19	65	1203	1287	19.8%
Jacksonville	2020 FBC-EC	1498	2819	2218	6535	
	2021 IECC w/o Eff Pkg	1482	2751	2254	6487	
	2021 IECC w/ WH Pkg	1485	2745	847	5077	
	Diff. FBC- IECC w/o Eff Pkg	16	68	-36	48	0.7%
	Diff. FBC- IECC w/ WH Pkg	13	74	1371	1458	22.3%

Adding skylights to the 2020 FBC-EC reference for houses with proposed skylights reduced the stringency of the FBC-EC for these cases to the point that even without the HPWH efficiency package, the 2021 IECC was slightly more efficient than the FBC-EC in Tampa and Jacksonville (a reversal from the other sample homes simulated).

Energy Rating Index

The Energy Rating Index (ERI) compliance option is not widely used in Florida,[6] so no simulations other than the maximum Index change discussed above in the Individual Code Changes section are provided in this report. Additional notable differences between the 2020 FBC-EC and 2021 IECC ERI include:

- New 2021 IECC Section R401.2.5 additional efficiency requirements also apply to ERI compliance, in this case requiring that the Index be 5% less than the Table R406.5 specified Index value (also further discussed above in the Individual Code Changes section).
- Section R406.4 code change RE184-19 limits the reduction in energy use of the rated design due to on-site renewable energy to 5 percent of the total energy use; this change will tend to increase stringency and cost for applicable ERI projects. The FBC-EC already has an envelope backstop for ERI projects that includes solar. ***Summary: This should be considered at the same time as determining the Index value and the added 5% stringency requirement.***

[6] In the authors' experience, the ERI compliance method in Florida is somewhat more stringent than the Performance or Prescriptive methods.

At an index of 49 or 52 maybe this should not apply but if the ERI remains 58 in Florida perhaps it should be considered.

- New Section R406.7.3 from code change RE204-19 requires that where onsite renewable energy is included in the calculation of an ERI, the code official must be provided with either 1) substantiation that the associated RECs are owned by, or retired on behalf of, the homeowner, or 2) a contract that conveys the RECs associated with the onsite renewable energy to the homeowner, or conveys an equivalent quantity of RECs associated with other renewable energy to the homeowner. If adopted in Florida, this change would result in a slight reduction in overall community energy use for applicable ERI projects as these RECs will not be used for offsetting others. The change would also slightly increase the cost of PV system for applicable ERI projects as utility or others cannot offset costs by selling RECs. ***Summary: Adopting the code change may keep financial benefits of clean energy production in the sunshine state and perhaps provide greater accountability.***

Cost Benefit Analysis of Moving Residential Energy Code from the 7th Edition (2020) FBC-EC to 2021 IECC for Those Items that Impact Energy Use

Economic cost and benefit analysis was performed for the impactful changes between the 2018 and 2021 IECC codes.[7] In order to isolate individual code changes, the same 2020 FBC-EC Prescriptive, 2,000 sq. ft. single story house was used for the base annual energy use for each comparison. Then the annual energy use of the same house with an individual 2021 IECC change was compared with this base house to show the impact of that one change. Cost and benefit analysis is provided for each of the additional efficiency package options and eight of the Individual Code Change section changes.

Some of the costs are very small, e.g., increasing the percentage of high efficacy lighting from 90% to 100%, and thus the benefits far outweigh the costs.

The cost and benefit analysis is summarized in Table 18. Red or negative values in savings mean the change would use more energy. Negative values in costs mean the measure might save on first cost. Note that the costs used for this analysis are estimates. Lower or higher actual costs will of course affect the cost effectiveness and desirability of these code changes. Costs were determined from FSEC's Maximum Energy Efficiency Cost Effectiveness in New Home Construction report or other sources as indicated below Table 18.

Two economic values are provided. One is net present value (NPV). Any positive net present value indicates that the measure is a smart economic choice relative to not making the investment. The second indicator is the savings to investment ratio (SIR). This is a ratio of the net present value of savings to the net present value of costs. If this value is 1.0 it is neutral. The higher the value the better the value of the option.

[7] Economic assumptions for SIR calculation: Down payment 10%; Mortgage interest rate 4.09%; General inflation rate 1.77%; Energy inflation rate 0.62%; Discount rate 3.77%; Mortgage period 30 years; Analysis period 30 years.

Table 18. Cost and benefits of individual 2021 IECC changes analyzed as individual changes. Green savings to investment ratio values (above 1.0) indicate a cost effective change.

	Code Change (2020 FBC to 2020 FBC w/ Change)	Est. Energy Savings (kWh/yr)	Est. Energy Savings (Therms/yr)	Est. Energy Savings ($/yr)	Incremental Compliance Cost ($)	Est. Life (yrs.)	Net Present Value NPV	Savings/ Investment SIR
Additional Efficiency Options per Section R401.2.5	**Section R408 Additional Efficiency Pkg. Options**							
	-- R408.2.1 Enhanced Envelope Performance	99		11.88	$402.00	30	($188.84)	0.55
	-- R408.2.2 More Efficient HVAC							
	a. SEER 16 AC and 95 AFUE Nat Gas Furnace	449	10.0	74.83	$1,356.00	15	($978.64)	0.59
	b. SEER 16 / HSPF 10 Heat Pump	513		61.56	$1,208.00	15	($969.65)	0.55
	-- R408.2.3 Reduced Water Heating Energy Use							
	a. 82 EF Fossil Fuel	2	26.9	56.61	$300.00	15	$550.67	**2.03**
	b. 2.0 EF Electric (3.45 UEF modeled)	965		115.80	$950.00	12	$50.92	**1.02**
	c. 0.4 Solar Fraction (29 sf. closed loop syst.)	1515		181.80	$6,695.00	20	($6,855.00)	0.34
	-- R408.2.4 More Efficient Duct System							
	a Ducts and AH 100% in thermal envelope	120		14.40	$6,135.00	30	($6,078.91)	0.04
	b. Ductless or Hydronic 100% in thermal env.	828		99.36	$5,500.00	15	($7,880.34)	0.19
	c. Ducts and AH 100% in conditioned space	731		87.72	$1,000.00	30	$644.45	**1.62**
	-- R408.2.5 ^ Air Sealing and Effic. Vent. System							
	3 ACH50 and 75% ERV w/ 1.2 cfm/w Fan	(229)		(27.48)	$1,500.00	15	($3,194.63)	(0.20)
	Individual Code Changes (change # from report)							
Individual Changes	#1: RE33-19 R-38 to R-49 CZ 2 ceilling insul	76		9.12	$770.00	30	($622.89)	0.22
	#2a: RE44-19 eave baffle installation @ $50 cost	27		3.24	$50.00	30	$10.27	**1.20**
	#2b: RE44-19 eave baffle installation @ $100 cost	27		3.24	$100.00	30	($41.52)	0.60
	#3: RE47-19 Pull-down stair hatch insulation	(1)		(0.12)	($8.00)	30	$5.99	
	#12: RE145-19 90% to 100% High Effic. Lighting	195		23.40	$0.12	6	$447.74	**925.89**
	#13 RE145-19 interior lighting controls	88		10.56	$88.00	30	$111.12	**2.22**
	#14 RE149-19 exterior lighting controls	23		2.73	$54.90	15	($45.36)	0.54
	#16: RE209-19 1.0 e-Ratio to 0.95 via ^ effic. HP	265		31.80	$604.00	6	($465.29)	0.57
	#18: RE218-19 High Effic. Lighting for Alterations	1339		160.68	$0.84	6	$3,074.42	**908.26**

Note: where applicable, costs are for 2,000 sq. ft. single story new construction Tampa home.

Cost sources: Lowe's comparison for 82 EF Fossil Fuel change and individual lighting changes #12, #14, and #18; combined various sources for water heating 2.0 EF Electric; correspondence with OUC for solar thermal system; FSEC estimate for ducts in thermal envelope, ductless thermal distribution system, air sealing + ERV, and individual change #2 Eave Baffle; Home Depot for individual changes #3 and #13. For all other changes cost source is: https://publications.energyresearch.ucf.edu/wp-content/uploads/2018/06/FSEC-RR-584-15.pdf

Discussion

A review of the various changes discussed above shows that making the 2021 IECC modifications represent a range of stringency impacts. Complicating the analysis this year are Sections R401.2.5 and R408.2, which require builders to choose any of five different efficiency package options for compliance that go beyond the historic Prescriptive and Performance methodology. The impact of these options vary greatly. In Climate Zone 2 the comparison between 2021 IECC Prescriptive with options varies from FBC-EC being 5% stricter to IECC being 17.5% stricter. In Climate Zone 1 the IECC Prescriptive is expected to be stricter in all cases.

However, most homes in Florida comply using the R405 Performance methodology. Without a 2021 IECC section R408 efficiency package option applied, our analysis indicates the FBC-EC to be about 1% to 5% more stringent than 2021 IECC except where skylights are included, in which case the codes are within 1% of each other. With Section R408 options though, for example by indicating the homes will comply with one of the high efficiency water heating package options, the 2021 IECC becomes 13% to 27% more efficient than the Florida code. Fortunately, both a tankless gas water heater and a heat pump water heater are cost effective for homes with reasonable amounts of hot water use. For small projects with anticipated occupancy of two or fewer people, builders may find other options such as the UA requirement less costly and more applicable. Table 19 shows the authors' opinions of the type of projects that will likely use each Section R408 efficiency package option and why. Although Section R401.2.5 adds some complications described earlier, the authors recommend it for the following reasons:

- It allows flexibility such that builders should be able to find a measure that works for their project
- One or more measures should prove cost effective for a project which is often the basis of the code modifications
- Without adopting this measure or something similar it will be difficult for the residential FBC-EC to show equivalence to the IECC
- With greater use, some of these options may come down in cost, improving cost effectiveness over time.

Table 19: Authors' opinions of the type of projects that will likely use each Section R408 efficiency package option and why.

R408 Efficiency Package Option	**Projects that are likely to comply using this methodology (Authors' opinions)**	**Why? Comments (Authors' opinions)**
R408.2.1 Enhanced Envelope Performance Option	Projects that currently comply by Prescriptive methodology and most multifamily projects.	Prescriptive projects may already be meeting the 0.95 UA and SHGC requirements. Multifamily projects have limited exterior surfaces and thus improving windows or wall insulation slightly may be least costly option.
R408.2.2 More Efficient HVAC Equipment Perf. Option	High end projects that have excellent thermal envelopes.	High end projects that may already be exceeding code may be able to comply by prescriptive or performance without this measure. However, some high end projects are using high efficiency HVAC to just meet the minimum code performance requirements. Those projects would need to add on another option. Since upgraded HVAC has a fair amount of cost this will often not be the low cost upgrade.

R408.2.3 Reduced Energy Use in Service Water-Heating Option	Many single family projects.	Upgraded tankless gas or heat pump water heaters are available for a net difference in cost of $1000 or less and offer a good return on investment. Heat pump water heaters provide added benefit of a small amount of cooling (typically 1/3 ton when running) to space they are in. Some utilities may help offset cost of these options. Note that performance compliance requires to show that the home would pass performance without the water heating upgrade so this might mean additional compliance effort for projects barely meeting code and already including those systems.
R408.2.4 More Efficient Duct Thermal Distribution System Option	Projects that already are putting ducts inside thermal envelope or using ductless systems and exceeding code. Many multifamily projects.	There are a number of builders using unvented attics with the thermal barrier at the roof. Multifamily projects often have all ductwork inside conditioned space. Note that performance compliance requires to show that the home would pass performance without the ducts in these preferred spaces so this might mean additional compliance effort for projects barely meeting code.
R408.2.5 Improved Air Sealing and Efficient Ventilation System	Healthy home and green home projects.	Projects that are incorporating high efficiency ERV systems already for compliance with an above code certification program may find this as a no cost option if they are also meeting the air tightness requirement.

Table 20 provides a summary of each 2021 IECC change evaluated with a quantifiable impact for homes that would be affected. The authors have provided a brief summary and recommendation in the right most column.

Table 20. Individual code change summary table of simulated items with costs and benefits.

Change	ICC Change #	Change Summary	Cost and Benefit Summary/ SIR	Recommendation
Individual Code Change #1	RE33 -19	Increases the Prescriptive Climate Zone 2 minimum ceiling insulation requirement from R-38 to R-49.	0.22	Not recommended for Florida unless actual cost much lower than estimated.
Individual Code Change #2	RE44 -19	Adds baffle installation language to mandatory Section R402.2.3.	0.60 @ $100 cost; 1.2 @ $50 cost	Practical requirement to improve quality of installations. May require minimal labor cost after becoming mandatory code. Cost effective for 2000 square foot single story Tampa home if cost is $60.
Individual Code Change #3	RE47 -19	Provides Section R402.2.4 insulation level exceptions for horizontal pull-down stair access hatches (R-13 instead of ceiling required insulation level).	N/A (negative cost)	Practical exception with insignificant energy penalty. Highly recommended.
Individual Code Change #12	RE145 -19	Changes high efficacy requirement in Section R404.1 from 90% of lighting to all lighting.	925.9	Highly cost effective. High efficacy LEDS available for almost every type of fixture now. This may occur with or without code but do not see any down side of recommending the change.
Individual Code Change #13	RE145 -19	Requires a dimmer, occupant sensor or other control for permanently installed lighting fixtures.	2.22	Saves on lighting and cooling. Recommended.
Individual Code Change #14	RE149 -19	Requires automatic shut off controls where total permanent installed exterior lighting power is greater than 30 watts.	0.54	Saves on lighting energy use but not cost effective.
Individual Code Change #16	RE209 -19	Additional Performance efficiency option reduces annual energy cost to 95% of annual energy cost of	0.57	Recommended as it would make Florida homes more efficient but cost effectiveness will depend on how one achieves it.

		the standard reference design		Upgraded HVAC not shown to be cost effective.
Individual Code Change #18	RE218-19	Reduces the Section R503.1.4 lighting efficacy exception from alterations that replace less than 50 percent of luminaires to those replacing less than 10 percent of luminaires .	908.3	Highly cost effective and recommended. Significant energy savings.

Conclusions

The authors have reviewed changes made to the 2021 IECC and evaluated whether the changes are likely to have a significant impact or are just a clarification. For the residential measures that would likely have a significant impact, energy analysis is included.

The 2021 IECC's most significant change is the additional energy efficiency requirements under new Section R401.2.5:

> 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 under 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 R405 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.

This report has examined a number of ways of complying with this new requirement. For the Prescriptive compliance path Section R408.2 offers builders the choice of any of five different options. Analysis indicates savings for a typical single family home in Florida will vary greatly depending on which option is chosen. One option is upgraded water heating systems and those

appear cost effective. Another option is a 5% improvement in SHGC and overall project *U*-value and that may be a low cost compliance method for certain projects. Other options include improved heating/cooling systems, ductless systems or ductwork inside thermal envelope or conditioned space, and a high efficacy ERV system.

For buildings complying with the Section R405 Total Building Performance Option (most current Florida projects) a builder can choose to comply using one of those R408.2 options as long as the home can achieve the required 1.0 e-Ratio without that measure. Another option for homes complying with the Total Building Performance Option is to achieve an e-Ratio of 0.95. This allows maximum flexibility of envelope and equipment components as Florida allows trade-offs in its Performance methodology.

For buildings complying with the ERI methodology Section R401.2.5 requires a 5% reduction from the maximum Table R406.5 ERI values, again allowing great flexibility.

This Section R401.2.5 additional efficiency requirements change is a departure from the historic methodologies. Whereas Prescriptive code in the past was all envelope related and had no options, now one of the five efficiency package options will have to be included and communicated to the official and four of the five options involve equipment, not envelope. The change also adds some more complexity to the Performance code although one can envision designers simply trying to meet an e-Ratio of 0.95 instead of 1.0. And the ERI change would simply set a new target.

Overall the authors provided four reasons for moving the 2021 IECC Section R401.2.5 change into the FBC-EC:

- It allows flexibility such that builders should be able to find a measure that works for their project
- One or more measures should prove cost effective for a project which is often the basis of the code modifications
- Without adopting this measure or something similar it will be difficult for the residential FBC-EC to show equivalence to the IECC
- With greater use, some of these options may come down in cost, improving cost effectiveness over time.

Another significant 2021 IECC change increases the *R*-value of ceiling insulation for Prescriptive compliance in Climate Zone 2 from the FBC-EC and 2018 IECC level of R-38 to R-49. The *U*-factor of the ceiling used in the standard reference design of the 2021 IECC Performance compliance method also becomes similarly more stringent. FSEC analysis found that if this option on its own added an estimated $770 first cost for a 2,000 square foot single story Tampa home, it would not be cost effective.

Another change in the 2021 IECC is going from a 90% requirement of high efficacy lighting to 100%. This reflects the current availability of high efficacy light fixtures and bulbs for virtually every reasonable light fixture. The cost premium for high efficacy lights is also very small. The difference from a June 2021 Lowe's visit was $1 per 16-pack of bulbs or about $0.06 a bulb. This change is highly cost effective and recommended.

There is a more significant lighting change and that is for existing homes. Section R503.1.4 of the 2021 IECC requires new lighting systems that are part of an alteration to comply with the lighting requirements and changes the exception from alterations that replace less than 50 percent of the lighting to those that replace less than 10%. This has very small cost and is a good investment and is recommended for adoption.

Two other 2021 IECC changes involve lighting control requirements-- one for interior lighting and one for exterior lighting. Based on anticipated cost effectiveness, the interior control requirement is recommended and the exterior control requirement is not recommended.

There are a number of other changes provided in the report that address installation practices, some specific exceptions and language meant to be clarifying. Of two new exceptions considered, one is recommended (attic hatch insulation of R-13 instead of ceiling level) and one is not (language allowing ductwork in exterior walls and floor cavities to be considered in conditioned space based on certain other parameters being in place). Two 2021 IECC changes are not recommended because the language leaves great room for interpretation. Two other changes are not recommended due to applicability in Florida.

One 2021 IECC change creates a thermal envelope efficiency backstop for all Performance projects. This backstop would likely impact the current building practice of a number of concrete block homes. Another change would rarely apply to Florida as it would only apply for duct systems not in attics or conditioned space.

The Florida Building Commission will need to determine if they want to update the code based on cost effectiveness criteria in which case some of the 2021 IECC changes should apply and some should not. Some of the clarifying language and installation practice code changes should be considered and discussed among stakeholders.

As discussed throughout this report, the biggest change is the Section R401.2.5 additional energy efficiency requirements. Without adopting that change or a similar one, it will be difficult to continue to show Florida's code is equivalent to the latest I-code.

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Appendix:

Residential 2021 IECC Changes Review Summary

(Meaningful changes to the Review Summary from the interim report version are shown <u>underlined</u>.)

Appendix: Residential 2021 IECC Changes Review Summary

Residential 2021 IECC changes with respect to the 2018 IECC and 2020 Florida Building Code, Energy Conservation (FBC-EC) are summarized in the table below. The table contains six columns defined as follows:

2021 IECC Section and Title: The 2021 IECC code section number and title for the code change.

ICC Code Change No.: Proposed code change number in the ICC's *Complete Revision History to the 2021 I-Codes* document.

Change Summary b/t 2018 IECC and 2021 IECC: Brief description of the code change between the 2018 IECC and 2021 IECC.

Change Summary b/t 2020 FBC-EC and 2021 IECC: Brief description of the code change between the 2020 FBC-EC and 2021 IECC.

Anticipated Energy Impact on FBC-EC if Adopted: Anticipated energy use impact from the code change if it is adopted in the FBC-EC. "None" means the code change has no or negligible anticipated impact on energy use.

Anticipated Cost Impact on FBC-EC if Adopted: Anticipated construction cost impact from the code change if it is adopted in the FBC-EC. "None" means the code change has no or negligible anticipated impact on construction cost.

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Table C. Residential Code Change Summary for 7th Edition (2020) Florida Energy Code vs. 2021 IECC

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
Chapter R1: Scope and Administration					
R102.1 General	CE9-19 Part II	Adds "energy conservation" to the compliance requirements for alternative materials, design or construction methods	The wording of the 2020 FBC-EC already implies that alternatives must be equivalent in energy efficiency	None	None
R102.1 General	CE10-19 Part II	Adds 1) that alternative materials, design or construction methods must be approved (by a code official), 2) that alternative applications must be in writing, and 3) that a code official's reasons for approval are to be in writing.	The 2020 FBC-EC already includes approval requirement; the requirements for applications and code officials' reasons for approval to be in writing would be the same as the change between 2018 IECC and 2021 IECC	None or slightly increased stringency in applicable cases	None or slightly increased cost in applicable cases
R102.1.1 Above Code Programs	CE42-19 Part II	Requirements change is part of a larger residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach to identifying mandatory provisions for each compliance method	Same as change between 2018 IECC and 2021 IECC	None	None
R102.1.1 Above Code Programs	CE12-19 Part II	Requires projects complying via an above code program to also meet the building thermal envelope and SHGC requirements in Tables R402.1.1 and 402.1.3 of the 2009 IECC	Same as change between 2018 IECC and 2021 IECC	None or slightly increased stringency in applicable cases	None or slightly increased cost in applicable cases
R103.1 General	ADM46-19 Part IV	Allows construction documents, technical reports and other supporting data to be submitted in a digital format where allowed by the code official	Same as change between 2018 IECC and 2021 IECC	None	None; Section R103.2 in both codes already allows construction documents to be submitted as electronic media

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
					documents where approved by the code official
R103.2 Information on Construction Documents	CE13-19 Part II	Adds energy compliance path to list of information required on construction documents	Same as change between 2018 IECC and 2021 IECC	None	None
Section 106 Notice of Approval, R106.1 Approval, R106.2 Revocation	ADM31-19 Part III	Editorial change moves Section R105.7 *Approval* and Section R105.7.1 *Revocation* to new Section R106 subsections R106.1 and R106.2	Same as change between 2018 IECC and 2021 IECC	None	None
Section R107 Validity	ADM31-19 Part III	Section renumbering due to creation of Section R106	Same as change between 2018 IECC and 2021 IECC	None	None
Section R108 Referenced Standards	ADM31-19 Part III	Section renumbering due to creation of Section R106	Same as change between 2018 IECC and 2021 IECC	None	None
Section R109 Stop Work Order	ADM31-19 Part III	Section renumbering due to creation of Section R106	Same as change between 2018 IECC and 2021 IECC	None	None
R109.1 Authority	ADM41-19 Part IV	Editorial changes to provide consistency between I-codes	Same as change between the 2018 IECC and 2021 IECC	None	None
R109.2 Issuance	ADM41-19 Part IV	Editorial changes to provide consistency between I-codes	Same as change between 2018 IECC and 2021 IECC	None	None
R109.4 Failure to Comply	ADM41-19 Part IV	Editorial changes to provide consistency between I-codes	Same as change between 2018 IECC and 2021 IECC	None	None
Section R110 Means of Appeals	ADM31-19 Part III	Section renumbering only due to creation of Section R106	Same as change between 2018 IECC and 2021 IECC	None	None
Section R110 Means of Appeals	ADM40-19 Part IV	Editorial change to section title to provide consistency between I-codes	Same as change between 2018 IECC and 2021 IECC	None	None
R110.1 General	ADM40-19 Part IV	Editorial changes to provide consistency between I-codes	Same as change between 2018 IECC and 2021 IECC	None	None
R110.2 Limitations on Authority	ADM40-19 Part IV	Editorial changes to provide consistency between I-codes	Same as change between 2018 IECC and 2021 IECC	None	None
R110.4 Administration	ADM40-19 Part IV	Editorial addition to provide consistency between I-codes	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
Chapter R2: Definitions					
[R202 Accessible]	CE29-19 Part II	"Accessible" term deleted in favor of new term "Access to"	Same as change between 2018 IECC and 2021 IECC	None	None
R202 Access (To)	CE29-19 Part II	New definition to replace "Accessible"	Same as change between 2018 IECC and 2021 IECC	None	None
[R202 Air Impermeable Insulation]	CE29-19 Part II	"Air impermeable insulation" term deleted; similar definition added to Chapter 3	Same as change between 2018 IECC and 2021 IECC	None	None
R202 Cavity Insulation	RE4-19	New definition to coordinate with commercial definitions	The 2020 FBC-EC already has this definition	None	None
R202 Continuously Burning Pilot Light	RE107-19	New definition to clarify what "continuous" means (shown as AMPC1 in monograph, but not included in code)	Same as change between 2018 IECC and 2021 IECC	None	None
R202 Demand Recirculation Water System	CE22-19 Part II	Revises definition to provide consistency with the IPC	The 2020 FBC-EC already has an almost identical definition	None	None
R202 Dimmer	RE145-19	New definition	Same as change between 2018 IECC and 2021 IECC	None	None
R202 Dwelling Unit Enclosure Area	RE88-19	New definition referred to in Section R402.4.1.2 changes (made via the same code change number).	Same as change between 2018 IECC and 2021 IECC	None	None
R202 Fenestration	RE6-19	Adds a list of products and components that are included as "skylights"	The 2020 FBC-EC already has an almost identical definition for skylights	None	None
R202 High-Efficacy Light Sources	RE7-19, RE145-19	Replaces "High-Efficiency Lamps" term with "High-Efficiency Light Sources," removes lumens per watt differentiation based on lamp wattage and increases high efficacy requirement	The 2020 FBC-EC already includes the same efficacy requirements in Section R404.1	None or slightly increased stringency in applicable cases	None or slightly increased cost in applicable cases
R202 Occupant Sensor Control	RE145-19	New definition referred to in new Section R404.2 Lighting Controls	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
		(made via the same code change number).			
R202 On-site Renewable Energy	CE31-19 Part II	New definition to help distinguish between renewable energy sources and site use	Same as change between 2018 IECC and 2021 IECC	None	None
[R202 Readily Accessible]	CE29-19 Part II	"Readily Accessible" term deleted in favor of new term "Access to"	Same as change between 2018 IECC and 2021 IECC	None	None
R202 Ready Access (To)	CE29-19 Part II	New definition to replace " Readily Accessible"	Same as change between 2018 IECC and 2021 IECC	None	None
R202 Renewable Energy Certificate (REC)	RE204-19	New definition of an instrument that represents the environmental attributes of renewable energy	Same as change between 2018 IECC and 2021 IECC	None	None
R202 Renewable Energy Resources	CE31-19 Part II	New definition to help distinguish between renewable energy sources and site use	Same as change between 2018 IECC and 2021 IECC	None	None
R202 Roof Recover	RE9-19 Part I	Replaces "Roof Re-cover" term with "Roof Recover" and slightly revises language	2020 FBC-EC already includes new term; otherwise same as change between 2018 IECC and 2021 IECC	None	None
R202 Thermal Distribution Efficiency (TDE)	CE151-19 Part II	New definition regarding duct heat loss calculation	Same as change between 2018 IECC and 2021 IECC	None	None
Chapter R3: General Requirements					
Table R301.1	CE36-19 Part II	Changes Climate Zone (CZ) and moisture regime for a number of US counties to align with ASHRAE Std. 169-2013; only Florida change is moving Palm Beach County from CZ 2A to 1A	2020 FBC-EC already has Palm Beach County in CZ 1A; no other changes affect Florida; 2021 IECC still lists Collier, Hendry, and Lee counties as CZ 2A while FBC-EC has these three counties as 1A	None	None
R301.3 Climate Zone Definitions	CE36-19 Part II	Changes name of section from International climate zones to Climate zone definitions and revises language regarding how to	Not applicable to Florida	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
		determine CZs of locations that are not listed			
Table R301.3 Thermal Climate Zone Definitions	CE36-19 Part II	Changes table number and name from Table R301.3(2) International Climate Zone Definitions to Table R301.3 Thermal Climate Zone Definitions, changes thermal criteria for a number of CZs and adds new CZ "0."	Adds upper boundary to CZ 1 thermal criteria; otherwise no changes relative to Florida	None	None
[Table R301.3(1) International Climate Zone Definitions.]	CE36-19 Part II	Deletes Table R301.3(1) which is no longer needed to determine CZs per Section R301.3	Not applicable to Florida	None	None
R303.1.2 Insulation Mark Installation	CE40-19 Part II	Specifies when and where an insulation certificate is to be provided	Same as change between 2018 IECC and 2021 IECC	None or slightly increased stringency	None
R303.1.5 Air-Impermeable insulation	CE19-19 Part II	Moves definition of air-impermeable insulation from Chapter 2 to Section R303.1.5 and adds air permeance limit and testing standard; intended as clarification	Same as change between 2018 IECC and 2021 IECC	None	None
R303.3 Maintenance information	CE29-19 Part II	Changes "accessible" to "visible" to clarify intent	Same as change between 2018 IECC and 2021 IECC	None	None
Chapter R4: Residential Energy Efficiency					
R401.2 Application	CE42-19 Part II	Removes word "Mandatory" from Section R405 compliance path option as part of a larger residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
R401.2 Application	RE209-19	Adds that new Section R401.2.5 *Additional energy efficiency* be	Same as change between 2018 IECC and 2021 IECC	Increased stringency	Increased cost

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
		complied with in addition to one of the existing compliance paths			
R401.2 Application	Unknown (RE15-19?)	Breaks out compliance options into separate subsections	Same as change between 2018 IECC and 2021 IECC	None	None
R401.2.1 Prescriptive Compliance Option	Unknown (RE15-19?)	Stipulates Prescriptive compliance option sections	Same as change between 2018 IECC and 2021 IECC	None	None
R401.2.2 Total Building Performance Option	Unknown (RE15-19?)	Stipulates Performance compliance option section	Same as change between 2018 IECC and 2021 IECC	None	None
R401.2.3 Energy Rating Index Option	Unknown (RE15-19?)	Stipulates Energy Rating Index (ERI) compliance option section	Same as change between 2018 IECC and 2021 IECC	None	None
R401.2.4 Tropical Climate Region Options	Unknown (RE15-19?)	Moves tropical climate region option to Section R407, but no change in stringency	Same as change between 2018 IECC and 2021 IECC	None	None
R401.2.5 Additional Energy Efficiency	RE209-19	New section establishes additional energy efficiency requirements applicable to each compliance approach	Same as change between 2018 IECC and 2021 IECC	Increased stringency	Increased cost
R401.3 Certificate	CE42-19 Part II	Removes “Mandatory” from section title as part of a larger residential IECC-wide formatting change that removes “mandatory” and “prescriptive” section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
R401.3 Certificate	RE18-19	Adds requirement to, where applicable, include on-site photovoltaic system information on the efficiency certificate	Same as change between 2018 IECC and 2021 IECC	None	None
R401.3 Certificate	RE20-19	Adds requirement to include code edition and compliance path on the efficiency certificate and restructures section into numbered bullet format	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
R401.3 Certificate	RE21-19	Adds requirement to, where applicable, include the Energy Rating Index score, with and without on-site generation, on the efficiency certificate and revises some text, including adding requirement to indicate equipment size	Same as change between 2018 IECC and 2021 IECC	None	None
R402.1 General	CE42-19 Part II	Removes "Prescriptive" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
R402.1.2 Insulation and Fenestration Criteria	RE38-19	Clarifies *U*-factor and SHGC requirements	Same as change between 2018 IECC and 2021 IECC	None	None
R402.1.3 R-value Alternative	RE38-19	New section specifying insulation *R*-value alternatives to *U*-factor requirements (part of section reorganization; no stringency changes)	Same as change between 2018 IECC and 2021 IECC	None	None
[R402.1.4 *U*-factor alternative]	RE38-19	Subsection deleted; no longer needed due to overall section reorganization	Same as change between 2018 IECC and 2021 IECC	None	None
R402.1.4 *R*-value computation	RE38-19	Subsection renumbered due to overall section reorganization	Same as change between 2018 IECC and 2021 IECC	None	None
R402.1.4 *R*-value computation	RE38-19	Clarifies cavity and continuous insulation (corresponds with new cavity insulation definition in Ch. 2)	Same as change between 2018 IECC and 2021 IECC	None	None
R402.1.5 Total UA alternative	CE42-19 Part II	Adds SHGC clarification and that Total UA alternative compliance must also meet the maximum fenestration *U*-factors of Section R402.5	Same as change between 2018 IECC and 2021 IECC (FBC-EC does not have a Section R402.5, but this section in the IECC does not include maximum *U*-factors for Climate Zone 1 or 2)	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
Table R402.1.2 Maximum Assembly *U*-factors and Fenestration Requirements	RE33-19	Decreases the maximum ceiling *U*-factor in Climate Zones 2 and 3 from 0.030 to 0.026	Same as change between 2018 IECC and 2021 IECC	Increased stringency for Prescriptive and Performance compliance projects in Climate Zone 2	Increased cost for Prescriptive and Performance compliance projects in Climate Zone 2
Table R402.1.2 Maximum Assembly *U*-factors and Fenestration Requirements	RE35-19	Decreases the maximum fenestration *U*-factor in Climate Zones 3 and 4 (except marine) from 0.032 to 0.030	Same as change between 2018 IECC and 2021 IECC	None (does not affect Florida Climate Zones)	None (does not affect Florida Climate Zones)
Table R402.1.2 Maximum Assembly *U*-factors and Fenestration Requirements	RE36-19	Decreases the maximum ceiling *U*-factor in Climate Zones 4 through 8 from 0.026 to 0.024	Same as change between 2018 IECC and 2021 IECC	None (does not affect Florida Climate Zones)	None (does not affect Florida Climate Zones)
R402.2.1 Ceilings with attic spaces	RE36-19	Adds minimum insulation *R*-value allowance for insulation extending over eave wall top plates which would otherwise be required to meet new minimum of *R*-60	Same as change between 2018 IECC and 2021 IECC	None (does not affect Florida Climate Zones)	None (does not affect Florida Climate Zones)
Table R402.1.2 Maximum Assembly *U*-factors and Fenestration Requirements	RE38-19	Adds Glazed Fenestration SHGC column to table, with same maximum values and footnotes as Table R402.1.3 (no stringency changes)	Same as change between 2018 IECC and 2021 IECC	None	None
Table R402.1.2 Maximum Assembly U-factors and Fenestration Requirements	RE29-19	Reduces maximum wood frame wall *U*-factors in Climate Zones 4 and 5 from 0.60 to 0.45	Same as change between 2018 IECC and 2021 IECC	None (does not affect Florida Climate Zones)	None (does not affect Florida Climate Zones)
Table R402.1.2 Maximum Assembly U-factors and Fenestration Requirements	RE41-19	Adds maximum vertical fenestration *U*-factor exception for high elevation and windborne debris regions in Climate zones Marine 4 through 8	Same as change between 2018 IECC and 2021 IECC	None (does not affect Florida Climate Zones)	None (does not affect Florida Climate Zones)

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
Table R402.1.3 Insulation Minimum *R*-values and Fenestration Requirements by Component	RE23-19	Clarifies basement and crawlspace wall *R*-value requirements for Climate Zones 3 through 8	Same as change between 2018 IECC and 2021 IECC	None (does not affect Florida Climate Zones)	None (does not affect Florida Climate Zones)
Table R402.1.3 Insulation Minimum *R*-values and Fenestration Requirements by Component	RE27-19	Adds wood frame wall minimum *R*-value options for all Climate Zones, including a new R-10 continuous insulation option (with no cavity insulation) for Climate Zones 1 and 2	Same as change between 2018 IECC and 2021 IECC	None; optional and intended to be of equivalent efficiency	None; optional
Table R402.1.3 Insulation Minimum *R*-values and Fenestration Requirements by Component	RE28-19	Clarifies cavity and continuous insulation use in the table (corresponds with new cavity insulation definition in Ch. 2)	Same as change between 2018 IECC and 2021 IECC	None	None
Table R402.1.3 Insulation Minimum *R*-values and Fenestration Requirements by Component	RE29-19	Increases minimum wood frame wall *R*-values in Climate Zones 4 and 5 from 20 or 13+5 to 20+5 or 13+10	Same as change between 2018 IECC and 2021 IECC	None (does not affect Florida Climate Zones)	None (does not affect Florida Climate Zones)
Table R402.1.3 Insulation Minimum *R*-values and Fenestration Requirements by Component	RE32-19	Increases slab insulation requirements in Climate Zones 3 through 5	Same as change between 2018 IECC and 2021 IECC	None (does not affect Florida Climate Zones)	None (does not affect Florida Climate Zones)
Table R402.1.3 Insulation Minimum *R*-values and Fenestration Requirements by Component	RE33-19	Increases the minimum ceiling *R*-value in Climate Zones 2 and 3 from R-38 to R-49	Same as change between 2018 IECC and 2021 IECC	Increased stringency for prescriptive projects in Climate Zone 2	Increased cost for prescriptive projects in Climate Zone 2

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
Table R402.1.3 Insulation Minimum *R*-values and Fenestration Requirements by Component	RE34-19	Removes floor insulation alternative that was applicable to Climate Zones Marine 4 through 8	Same as change between 2018 IECC and 2021 IECC	None (does not affect Florida Climate Zones)	None (does not affect Florida Climate Zones)
Table R402.1.3 Insulation Minimum *R*-values and Fenestration Requirements by Component	RE35-19	Decreases the maximum fenestration *U*-factor in Climate Zones 3 and 4 (except marine) from 0.032 to 0.030, and adds maximum vertical fenestration *U*-factor exception for high elevation and windborne debris regions in Climate zones 3 through 8	Same as change between 2018 IECC and 2021 IECC	None (does not affect Florida Climate Zones)	None (does not affect Florida Climate Zones)
Table R402.1.3 Insulation Minimum *R*-values and Fenestration Requirements by Component	RE36-19	Increases the minimum ceiling *R*-value in Climate Zones 4 through 8 from R-49 to R-60	Same as change between 2018 IECC and 2021 IECC	None (does not affect Florida Climate Zones)	None (does not affect Florida Climate Zones)
Table R402.1.3 Insulation Minimum *R*-values and Fenestration Requirements by Component	RE37-19	Changes glazed fenestration SHGC requirement in Climate Zones Marine 4 and 5 from "NR" to 0.40	Same as change between 2018 IECC and 2021 IECC	None (does not affect Florida Climate Zones)	None (does not affect Florida Climate Zones)
Table R402.1.3 Insulation Minimum *R*-values and Fenestration Requirements by Component	RE38-19	Renumbers table from Table R402.1.2 to Table R402.1.3 and adds "Minimum R-value" to table title	Same as change between 2018 IECC and 2021 IECC	None	None
R402.2 Specific Insulation Requirements	CE42-19 Part II	Removes "Prescriptive" from section title as part of residential IECC-wide formatting change that removes "mandatory" and	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
		"prescriptive" section labels in favor of a tabular approach			
R402.2.1 Ceilings with Attic Spaces	RE42-19	As a clarification, adds "or attic" to wherever "ceiling" is referred to in this section	Same as change between 2018 IECC and 2021 IECC	None	None
R402.2.2 Ceilings without attics	RE42-19	Clarifies applicability of section	Same as change between 2018 IECC and 2021 IECC	None	None
R402.2.3 Eave Baffle	RE44-19	Adds "net free area" to the baffle opening stipulation and adds baffle installation language to maximize space for attic insulation coverage and prevent ventilation air bypass	Same as change between 2018 IECC and 2021 IECC	Slightly increased stringency (depending on typical practice)	Slightly increased cost (depending on typical practice)
R402.2.3 Eave Baffle	RE45-19	Makes this section mandatory	Same as change between 2018 IECC and 2021 IECC	Slightly increased stringency for Performance and ERI compliance	Slightly increased cost for Performance and ERI compliance
R402.2.4 Access Hatches and Doors	RE46-19	Separates existing prescriptive Section R402.2.4 into mandatory and prescriptive sections; remaining Section R402.2.4 text regarding access hatch and door insulation levels continues to be prescriptive	Same as change between 2018 IECC and 2021 IECC	None	None
R402.2.4.1 Access Hatches and Door Insulation Installation and Retention	RE46-19	Separates existing prescriptive Section R402.2.4 into mandatory and prescriptive sections; new Section R402.2.4.1 regarding access hatch and door installation is now mandatory	Same as change between 2018 IECC and 2021 IECC	Slightly increased stringency for Performance and ERI compliance	Slightly increased cost for Performance and ERI compliance
R402.2.4 Access Hatches and Doors	RE47-19	Provides insulation level exceptions for horizontal pull-down stair type access hatches	Same as change between 2018 IECC and 2021 IECC	Slightly decreased stringency in applicable cases	Slightly decreased cost in applicable cases
R402.2.4.1 Access Hatches and Door Insulation	RE49-19	Expands requirements regarding retaining attic insulation to ensure that it performs as intended	Same as change between 2018 IECC and 2021 IECC	Slightly increased stringency	Slightly increased cost

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
Installation and Retention					
R402.2.5 Mass Walls	RE50-19	Adds "mass timber" to listing of mass wall options	Same as change between 2018 IECC and 2021 IECC	None	None or slightly decreased cost in applicable cases
Table R402.2.6 Steel-Frame Ceiling, Wall and Floor Insulation *R*-Values	RE51-19	Coordinates Table R402.2.6 equivalent cold-formed steel-frame *R*-value options with Table R402.1.2 wood frame *R*-value options	Same as change between 2018 IECC and 2021 IECC	None (no changes that apply to Florida Climate Zones)	None (no changes that apply to Florida Climate Zones)
[R402.2.7 Walls with partial structural sheathing]	RE52-19	Removes section which had allowed reduced continuous wall insulation *R*-value than otherwise required by Table R402.1.3 for areas of walls covered by structural sheathing (for applicable projects)	Same as change between 2018 IECC and 2021 IECC	None (FBC-EC Table R402.1.2 does not include a continuous wall insulation option for Climate Zone 1 or 2)	None (FBC-EC Table R402.1.2 does not include a continuous wall insulation option for Climate Zone 1 or 2)
R402.2.7 Floors	RE52-19	Section renumbered due to removal of existing Section R402.2.7	Same as change between 2018 IECC and 2021 IECC	None	None
R402.2.7 Floors	RE53-19	Clarifies floor cavity insulation installation requirements	Same as change between 2018 IECC and 2021 IECC	None	None
R402.2.8 Basement Walls	Due to RE52-19	Section renumbered from R402.2.9 due to removal of existing Section R402.2.7	Same as change between 2018 IECC and 2021 IECC	None	None
R402.2.8 Basement Walls	RE59-19	Changes include 1) new language that clarifies basement walls are to be insulated according to Table R402.1.3, 2) rewording of requirement for basement wall insulation for unconditioned basements with insulated floor overhead as an exception, and 3) breaking out basement wall insulation installation requirements into new subsection	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
R402.2.8 Basement Walls	Unknown	Expands list of requirements that must be met to exempt unconditioned basements from basement wall insulation requirement	Same as change between 2018 IECC and 2021 IECC	Increased stringency for applicable prescriptive projects	Increased cost for applicable prescriptive projects
R402.2.8.1 Basement Wall Insulation Installation	RE59-19	Part of Section R402.2.8 rewording; new subsection now used to specify basement wall insulation installation requirements	Same as change between 2018 IECC and 2021 IECC	None	None
R402.2.9 Slab-on-grade Floors	Due to RE52-19	Section renumbered from R402.2.10 due to removal of existing Section R402.2.7	Same as change between 2018 IECC and 2021 IECC	None	None
R402.2.9 Slab-on-grade Floors	RE60-19	Reorganizes section and breaks out slab-on-grade floor insulation installation requirements into new subsection	Same as change between 2018 IECC and 2021 IECC	None	None
R402.2.9.1 Slab-on-Grade Insulation Installation	RE60-19	Part of Section R402.2.9 rewording; new subsection now used to specify slab-on-grade floor insulation installation requirements	Same as change between 2018 IECC and 2021 IECC	None	None
R402.2.10 Crawl Space Walls	Due to RE52-19	Section renumbered from R402.2.11 due to removal of existing Section R402.2.7	Same as change between 2018 IECC and 2021 IECC	None	None
R402.2.10 Crawl Space Walls	RE62-19	Breaks previously Prescriptive crawl space walls Section into Prescriptive insulation level and mandatory insulation installation sections	Same as change between 2018 IECC and 2021 IECC	Slightly increased stringency for Performance and ERI compliance	Slightly increased cost for Performance and ERI compliance
R402.2.10.1 Crawl Space Wall Insulation Installation	RE62-19	Part of Section R402.2.10 rewording; new subsection now used to specify crawl space wall insulation installation requirements; also now included as requirements for R405	Same as change between 2018 IECC and 2021 IECC	Slightly increased stringency for Performance and ERI compliance	Slightly increased cost for Performance and ERI compliance

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
		Performance and R406 ERI compliance			
R402.2.11 Masonry Veneer	Due to RE52-19	Section renumbered from R402.2.12 due to removal of existing Section R402.2.7	Same as change between 2018 IECC and 2021 IECC	None	None
R402.2.12 Sunroom and Heated Garage Insulation	Due to RE52-19	Section renumbered from R402.2.13 due to removal of existing Section R402.2.7	Same as change between 2018 IECC and 2021 IECC	None	None
R402.2.12 Sunroom and Heated Garage Insulation	RE100-19	Heated garages must now also meet this section's sunroom requirements and are also eligible for sunroom thermal isolation exception	Same as change between 2018 IECC and 2021 IECC	Slightly less stringency in applicable cases	Slightly less cost in applicable cases
R402.3 Fenestration	CE42-19 Part II	Removes "Prescriptive" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
402.3.5 Sunroom and Heated Garage Fenestration	RE100-19	Heated garages must now also meet this section's sunroom fenestration requirements and are also eligible for sunroom thermal isolation exception	Same as change between 2018 IECC and 2021 IECC	Slightly less stringency in applicable cases	Slightly less cost in applicable cases
R402.4 Air leakage	CE42-19 Part II	Removes "Mandatory" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
Table R402.4.1.1 Air Barrier, Air Sealing and Insulation Installation: General Requirements	RE58-19	Removes redundant General Requirements section air barrier language	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
Table R402.4.1.1 Air Barrier, Air Sealing and Insulation Installation: Plumbing, Wiring or Other Obstructions	RE68-19	Adds language to Plumbing and Wiring section title and air barrier criteria, and revises Insulation Installation Criteria language to clarify existing requirements	Same as change between 2018 IECC and 2021 IECC	None or slightly increased stringency depending on interpretation of existing language	None or slightly increased cost depending on interpretation of existing language
Table R402.4.1.1 Air Barrier, Air Sealing and Insulation Installation: Recessed Lighting	RE70-19	Revises Recessed Lighting section language, reinforcing that Section R402.4.5 *Recessed lighting* is also mandatory for R405 and R406 projects and clarifying recessed lighting insulation requirements	Same as change between 2018 IECC and 2021 IECC	None or slightly increased stringency depending on interpretation of existing language	None or slightly increased cost depending on interpretation of existing language
Table R402.4.1.1 Air Barrier, Air Sealing and Insulation Installation: Garage Separation	RE71-19	Adds language to the Garage Separation section's previously blank Insulation Installation Criteria to clarify that insulation is required here as for any other wall or floor component that separates conditioned space from unconditioned space	Same as change between 2018 IECC and 2021 IECC	None	None
Table R402.4.1.1 Air Barrier, Air Sealing and Insulation Installation: Narrow Cavities	RE72-19	Adds language to the Narrow Cavities section's previously blank Air Barrier Criteria to clarify that narrow cavities must be air sealed	Same as change between 2018 IECC and 2021 IECC	None	None
Table R402.4.1.1 Air Barrier, Air Sealing and Insulation Installation: Shafts, Penetrations	Unknown (closest is RE73-19)	Adds language to the Shafts, Penetrations section's previously blank Insulation Installation Criteria to clarify that insulation must be fitted tightly around utilities passing through thermal envelope shafts and penetrations	Same as change between 2018 IECC and 2021 IECC	None	None
Table R402.4.1.1 Air Barrier, Air	RE74-19, RE106-19	Revises section name to clarify foundation types that are	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
Sealing and Insulation Installation: Basement Crawl Space and Slab Foundations		included, and revises and adds to Air Barrier Criteria and Insulation Installation Criteria to clarify foundation related requirements			
Table R402.4.1.1 Air Barrier, Air Sealing and Insulation Installation: Rim Joists	RE82-19	Adds "Air Sealing" to table title, revises and adds language to Rim Joists section's Air Barrier Criteria and Insulation Installation Criteria, and adds footnote to clarify rim joist related requirements	Same as change between 2018 IECC and 2021 IECC	None	None
Table R402.4.1.1 Air Barrier, Air Sealing and Insulation Installation: Shafts, Penetrations	RE73-19, RE86-19	Adds language to the Shafts, Penetrations section's Air Barrier Criteria to clarify sealing requirements for utility penetrations	Same as change between 2018 IECC and 2021 IECC	None	None
R402.4.1.2 Testing	RE88-19	Adds square footage based air leakage rate testing alternative for attached single and multifamily building dwelling units and buildings or dwelling units that are 1500 square feet or smaller, and also clarifies mechanical ventilation requirements	Same as change between 2018 IECC and 2021 IECC	See final report	See final report
R402.4.1.2 Testing	RE100-19	Clarifies that air leakage testing is to be performed after building penetrations are sealed, and adds air leakage testing exception for certain heated, attached and detached private garages	Same as change between 2018 IECC and 2021 IECC	Slightly decreased stringency in applicable cases	Slightly decreased cost of construction in applicable cases
R402.4.1.2 Testing	RE96-19	Sets mandatory maximum building air leakage rate in all Climate Zones to 5 ACH50; also adds decimal place to ACH50	Same as change between 2018 IECC and 2021 IECC	2018 IECC already had 5 ACH50 for our climate zones	2018 IECC already had 5 ACH50 for our climate zones

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
		values ("5" to "5.0") to clarify intent			
R402.4.1.3 Leakage Rate	RE96-19	New section allows the mandatory maximum leakage rate of 5.0 ACH50 to apply to Prescriptive compliance in Climate Zones 0 through 2 while continuing to require 3.0 ACH50 for Prescriptive compliance in Climate Zones 3 through 8	Same as change between 2018 IECC and 2021 IECC	2018 IECC already had 5 ACH50 for our climate zones	2018 IECC already had 5 ACH50 for our climate zones
R402.4.6 Electrical and Communication Outlet Boxes (air-sealed boxes)	RE103-19	New section stipulates maximum air leakage requirements for electrical and communication boxes	Same as change between 2018 IECC and 2021 IECC	None (proponent states this is an alternative to already required sealing)	None (proponent states this is an alternative to already required sealing)
R402.5 Maximum fenestration U-factor and SHGC	CE42-19 Part II	Removes "Mandatory" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
R402.5 Maximum fenestration U-factor and SHGC	RE-93-19	Adds a fenestration *U*-factor and SHGC exception for storm shelters in compliance with ICC 500	Same as change between 2018 IECC and 2021 IECC	Slightly decreased stringency in applicable cases	Slightly decreased cost of construction in applicable cases
R402.5 Maximum fenestration U-factor and SHGC	RE-105-19	Reduces the maximum area-weighted average fenestration SHGC permitted for Performance compliance in Climate Zones 0 through 3 from 0.50 to 0.40	Same as change between 2018 IECC and 2021 IECC (in FBC-EC, addressed in Section R405.5.3.4)	Increases stringency of Performance Compliance	Increases cost of Performance Compliance
R403.1 (IRC N1103.1) Controls	CE42-19 Part II	Removes "Mandatory" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
R403.1.1 Programmable Thermostat	Unknown	Adds that programmable thermostats must be able to maintain different set points for different days of the week	Same as change between 2018 IECC and 2021 IECC	None	None
R403.1.2 Heat Pump Supplementary Heat	CE42-19 Part II	Removes "Mandatory" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
R403.2 Hot Water Boiler Temperature Reset	RE108-19	Revises section language for hot water boiler control schemes to match DOE standard	Same as change between 2018 IECC and 2021 IECC	None	None
R403.3.1 Ducts Located Outside Conditioned Space	RE109-19	Changes section title from "Insulation" to "Ducts Located Outside Conditioned Space" and revises section to require R-8 duct insulation for 3" diameter and larger ducts located in unconditioned space, which previously applied only to ducts located in attics	Same as change between 2018 IECC and 2021 IECC	Slightly increased stringency in some cases (homes with ducts in crawlspaces or other non-attic unconditioned space)	Slightly increased cost in some cases (homes with ducts in crawlspaces or other non-attic unconditioned space)
R403.3.1 Ducts Located Outside Conditioned Space	RE111-19	Changes section from Prescriptive to Mandatory (so combined with RE109-19, in part means ducts outside of conditioned space must be insulated to R-8 for all compliance options)	Same as change between 2018 IECC and 2021 IECC	Slightly increased stringency for Performance and ERI compliance	Slightly increased cost for Performance and ERI compliance
R403.3.1 Ducts Located Outside Conditioned Space	CE151-19 Part II	Adds insulation requirements for ducts buried beneath a building	Same as change between 2018 IECC and 2021 IECC	None or slightly decreased stringency (due to equivalent thermal distribution efficiency option) in applicable cases	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
R403.3.2 Ducts Located in Conditioned Space	RE109-19	Clarifies existing option that allows ductwork to be considered as being inside conditioned space, and adds two new options-- for ductwork in floor cavities and within exterior walls	Same as change between 2018 IECC and 2021 IECC, except current FBC-EC does not include this section at all, so additional language would be needed to create section	Slightly less stringent in some cases	None (optional)
R403.3.3.1 Effective *R*-value of Deeply Buried Ducts	Unknown	Clarifies that this section applies to Performance compliance	Same as change between 2018 IECC and 2021 IECC (FBC-EC does not include this section at all)	None	None
R403.3.4 Sealing	CE42-19 Part II	Removes "Mandatory" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
R403.3.5 Duct Testing	CE42-19 Part II	Removes "Mandatory" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
R403.3.5 Duct Testing	RE112-19	Removes exception that had exempted projects with ducts and air handlers located entirely within the building thermal envelope from the duct testing requirement	Same as change between 2018 IECC and 2021 IECC (except would not apply to FBC-EC Performance projects)	Increased stringency in applicable cases	Increased cost in applicable cases
R403.3.5 Duct Testing	RE114-19	Adds that duct testing is to be in accordance with ANSI/RESNET/ICC 380 or ASTM E1554	FBC-EC already requires testing in accordance with ANSI/RESNET/ICC 380; would add ASTM E1554 option	None	None
R403.3.5 Duct Testing	RE118-19	Clarifies types of ventilation systems noted in exception that are not required to have tested ducts	FBC-EC does not currently include any ventilation system duct testing exception language	Depends on understanding of FBC-EC not including this	Depends on understanding of FBC-EC not including this

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
				exception (would mean slightly increased stringency if FBC-EC interpreted as currently not requiring non-integrated ventilation system testing)	exception (would mean slightly increased cost if FBC-EC interpreted as currently not requiring non-integrated ventilation system testing)
R403.3.5 Duct Testing	Unknown	Adds heating and cooling to types of ducts in exception that are not required to be tested if not integrated with ducts serving heating or cooling systems	FBC-EC does not currently include any ventilation system duct testing exception language, so entire exception would be new	Unknown / not clear how new language should be understood	Unknown / not clear how new language should be understood
R403.3.6 Duct leakage	CE42-19 Part II	Removes "Prescriptive" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
R403.3.6 Duct leakage	RE112-19	Adds Prescriptive compliance total duct leakage limit of 8 cfm/100 sq. ft. for cases in which all ducts and air handlers are located entirely within the building thermal envelope	Same as change between 2018 IECC and 2021 IECC	Increased stringency in applicable Prescriptive cases	Increased cost in applicable Prescriptive cases
R403.3.7 Building cavities	CE42-19 Part II	Removes "Mandatory" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
R403.4 Mechanical system piping insulation	CE42-19 Part II	Removes "Mandatory" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
R403.5.1 Heated Water circulation and Temperature Maintenance Systems	CE42-19 Part II	Removes "Mandatory" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
R403.5.1 Heated Water circulation and Temperature Maintenance Systems	CE29-19 Part II	"Readily Accessible" term deleted in favor of new term "in a location with ready access"	Same as change between 2018 IECC and 2021 IECC	None	None
R403.5.1.1 Circulation systems	CE159-19 Part II	Clarification removes some section text and moves the language that limits the temperature of water entering the cold-water piping for heated water recirculation systems from the Demand recirculation water systems section to this section	Same as change between 2018 IECC and 2021 IECC	None	None
R403.5.1.1.1 Demand recirculation water systems	CE159-19 Part II	Reorganizes section language due to CE159-19 Part II moving part of its text to another section	Same as change between 2018 IECC and 2021 IECC	None	None
R403.5.1.1.1 Demand recirculation water systems	RE125-19	Clarifies that the section only applies where a demand recirculation water system is installed, and makes the section mandatory	Same as change between 2018 IECC and 2021 IECC	Slightly increased stringency in applicable Performance and ERI compliance cases	Slightly increased cost in applicable Performance and ERI compliance cases
R403.5.2 Hot Water Pipe Insulation	CE42-19 Part II	Removes "Prescriptive" from section title as part of residential	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
		IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach			
R403.5.2 Hot Water Pipe Insulation	RE127-19	Clarifies hot water pipe insulation requirements	Same as change between 2018 IECC and 2021 IECC	None	None
R403.5.3 Drain Water Heat Recovery Units	RE129-19	Clarifies that the section only applies where a drain water heat recovery unit is installed, and makes the section mandatory	Same as change between 2018 IECC and 2021 IECC	Slightly increased stringency in applicable Performance and ERI compliance cases	Slightly increased cost in applicable Performance and ERI compliance cases
R403.6 Mechanical Ventilation	CE42-19 Part II	Removes "Mandatory" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
R403.6 Mechanical Ventilation	RE132-19	Clarifies mechanical ventilation requirements	Same as change between 2018 IECC and 2021 IECC	None	None
R403.6.1 Heat or Energy Recovery Ventilation	RE139-19	New mandatory section requires a balanced heat recovery or energy recovery ventilation system in climate zones 7 and 8	Same as change between 2018 IECC and 2021 IECC	None (does not affect Florida Climate Zones)	None (does not affect Florida Climate Zones)
R403.6.2 Whole-Dwelling Mechanical Ventilation System Fan Efficacy	RE136-19	Clarifies how efficacy for fans used to provide whole-house mechanical ventilation must be determined and provides testing standard	Same as change between 2018 IECC and 2021 IECC	None	None
R403.6.2 Whole-Dwelling Mechanical Ventilation System Fan Efficacy	RE134-19	Removes efficacy exception for air handlers that are integral to HVAC equipment used to provide whole-house mechanical ventilation (efficacy requirement added for these systems is addressed in Table R403.6.1 changes, noted below); also	Same as change between 2018 IECC and 2021 IECC	Increased stringency in applicable cases	Increased cost in applicable cases

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
		changes "whole-house" to "whole-dwelling" in table title			
Table R403.6.2 Whole-Dwelling Mechanical Ventilation System Fan Efficacy	RE134-19	As part of RE134-19 changes, adds efficacy requirement to table for air handlers that are integral to HVAC equipment used to provide whole-house mechanical ventilation; also changes "whole-house" to "whole-dwelling" in table title	Same as change between 2018 IECC and 2021 IECC	Increased stringency in applicable cases	Increased cost in applicable cases
Table R403.6.2 Whole-Dwelling Mechanical Ventilation System Fan Efficacy	RE133-19	Increases the efficacy requirements for three of the fan locations listed in the table	Same as change between 2018 IECC and 2021 IECC	None (based on proponent's research)	None (based on proponent's research)
Table R403.6.2 Whole-Dwelling Mechanical Ventilation System Fan Efficacy	RE137-19	Clarifies table by changing fan types shown to broader categories and listing exhaust fans by minimum airflow rate	Same as change between 2018 IECC and 2021 IECC	None	None
R403.6.3 Testing	RE130-19	New section requiring testing of mechanical ventilation systems, with exception for certain kitchen range hoods	Same as change between 2018 IECC and 2021 IECC	Unknown	Slightly increased cost in applicable cases
R403.7 Equipment Sizing and Efficiency Rating	CE42-19 Part II	Removes "Mandatory" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
R403.8 Systems Serving Multiple Dwelling Units	CE42-19 Part II	Removes "Mandatory" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
R403.9 Snow Melt and Ice System Controls	CE42-19 Part II	Removes "Mandatory" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
R403.10 Energy Consumption of Pools and Spas	CE42-19 Part II	Removes "Mandatory" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
R403.10 Energy Consumption of Pools and Spas	CE160-19 Part II	Revises section language slightly	Same as change between 2018 IECC and 2021 IECC	None	None
R403.10.1 Heaters	CE29-19 Part II	"Readily accessible" term deleted in favor of new term "in a location with ready access"	Same as change between 2018 IECC and 2021 IECC	None	None
R403.10.2 Time Switches	CE160-19 Part II	Clarifies that the equipment controlled by time switches in this section are heaters and pump motors	Same as change between 2018 IECC and 2021 IECC	None	None
R403.10.3 Covers	CE160-19 Part II	Revises section language slightly	Specific change would not apply to FBC-EC due to section wording differences	None	None
R403.11 Portable Spas	CE42-19 Part II	Removes "Mandatory" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
R403.12 Residential Pools and Permanent Residential Spas	RE144-19	Makes section mandatory but clarifies that it only applies if these pools and/or spas are installed	Same as change between 2018 IECC and 2021 IECC	None (per proponent)	None (per proponent)
R403.12 Residential Pools and	CE160-19 Part II	Revises section language for consistency with the ISPSC	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
Permanent Residential Spas					
R404.1 Lighting equipment	CE42-19 Part II	Removes "Mandatory" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
R404.1 Lighting equipment	RE7-19	Changes "lamps" to "lighting sources" to include high efficiency luminaries that do not include lamps, and excludes kitchen appliance lighting fixtures from lighting efficacy requirements	High efficiency luminaries that do not include lamps are already included in the FBC-EC; kitchen appliance lighting exclusion would be same as change between 2018 IECC and 2021 IECC	None or slightly decreased stringency	None or slightly decreased cost
R404.1 Lighting equipment	RE145-19	Changes permanent lighting high efficacy requirement from 90% of lighting to all lighting.	Same as change between 2018 IECC and 2021 IECC	Slightly increased stringency	Slightly increased cost
R404.1.1 Exterior Lighting	RE148-19	With several exceptions (including for detached one and two family dwellings and compliance with Section R404.1), this new section requires connected exterior lighting for residential buildings to comply with commercial exterior lighting Section C405.4	Same as change between 2018 IECC and 2021 IECC	None or slightly increased stringency	None or slightly increased cost
R404.1.2 Fuel Gas Lighting Equipment	CE42-19 Part II	Removes "Mandatory" from section title as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
R404.2 Interior Lighting Controls	RE145-19	With several exceptions, new mandatory section requires either a dimmer, occupant sensor or other control built into the fixture	Same as change between 2018 IECC and 2021 IECC	Increased stringency	Increased cost

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
		for permanently installed lighting fixtures			
R404.3 Exterior Lighting Controls	RE149-19	New Prescriptive section requires specified automatic shut off controls where total permanent installed exterior lighting power is greater than 30 watts	Same as change between 2018 IECC and 2021 IECC	Slightly increased stringency in applicable Prescriptive cases	Slightly increased cost in applicable Prescriptive cases
Section R405 Total Building Performance	CE42-19 Part II	Changes section name from "Simulated Performance Alternative (Performance)"	Same as change between 2018 IECC and 2021 IECC	None	None
R405.2 Performance-Based Compliance	CE42-19 Part II	Changes section name from "Mandatory Requirements," adds that the proposed design must meet the requirements of the sections indicated in new Table R405.2 (a consolidated listing of what were formerly identified as "Mandatory" requirements) and moves the Section R405.3 Performance based compliance requirements to this section	Same as change between 2018 IECC and 2021 IECC	None	None
R405.2 Performance-Based Compliance	RE111-19	Moves the Performance compliance duct insulation requirements from this section to Section R403.3.1	Same as change between 2018 IECC and 2021 IECC	None	None
R405.2 Performance-Based Compliance	RE151-19	Requires Performance compliance project envelope efficiency to meet or exceed residential 2009 IECC Table 402.1.1 or Table 402.1.3	Same as change between 2018 IECC and 2021 IECC	Increased stringency for Performance projects	Increased cost for Performance projects
Table R405.2 Requirements for Total Building Performance	CE42-19 Part II	New table providing the additional requirements for Performance compliance-- part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
[R405.3 Performance Based Compliance]	CE42-19 Part II	Deletes section and moves its Performance compliance requirements to Section R405.2	Same as change between 2018 IECC and 2021 IECC	None	None
R405.3 Documentation	Due to CE42-19 Part II	Section renumbered from R405.4 due to removal of existing Section R405.3	Same as change between 2018 IECC and 2021 IECC	None	None
R405.3.1 Compliance Software Tools	Due to CE42-19 Part II	Section renumbered from R405.4.1 due to removal of existing Section R405.3	Same as change between 2018 IECC and 2021 IECC	None	None
R405.3.2 Compliance Report	Due to CE42-19 Part II	Section renumbered from R405.4.2 due to removal of existing Section R405.3	Same as change between 2018 IECC and 2021 IECC	None	None
R405.3.2 Compliance Report	RE157-19	Removes language allowing batch sampling for stacked multi-family units	FBC-EC already prohibits batch sampling	None	None
R405.3.2 Compliance Report R405.3.2.1 Compliance Report for Permit Application R405.3.2.2 Compliance Report for Certificate of Occupancy	RE158-19	Revises and reorganizes section and subsections, and moves Section R405.3.3 content here; intended to clarify and improve usability, not add new requirements, but also adds requirement to show onsite renewable type and production size on the certificate of occupancy report	Same as change between 2018 IECC and 2021 IECC	None	None
R405.3.2.2 Compliance Report for Certificate of Occupancy	RE159-19	Adds requirement to declare the total building performance path on the title page of the energy report and building plans	Same as change between 2018 IECC and 2021 IECC	None	None
[R405.4.3 Additional documentation]	RE158-19	Deletes section for content in Section R405.3.2	Same as change between 2018 IECC and 2021 IECC	None	None
R405.4 Calculation Procedures	Due to CE42-19 Part II	Sections renumbered from R405.4, R405.4.1 and R405.4.2	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
R405.4.1 General R405.4.2 Residential Specifications		due to removal of existing Section R405.3			
Table R405.4.2(1) Specifications for the Standard Reference and Proposed Designs	Due to CE42-19 Part II	Table R405.5.2(1) renumbered due to removal of existing Section R405.3	Same as change between 2018 IECC and 2021 IECC	None	None
Table R405.4.2(1) Specifications for the Standard Reference and Proposed Designs: Air Exchange Rate	RE98-19	Adds decimal place to Air Exchange Rate section reference ACH50 values ("3" to "3.0" and "5" to "5.0") to clarify intent	FBC-EC already provides ACH50 values to two decimal places	None	None
Table R405.4.2(1) Specifications for the Standard Reference and Proposed Designs: Service Water Heating	RE162-19	Reduces proposed design hot water use based on compactness of the hot water distribution system	Same as change between 2018 IECC and 2021 IECC	None or slightly reduced stringency for Performance projects	None or reduced cost for Performance projects
Table R405.4.2(1) Specifications for the Standard Reference and Proposed Designs: Service Water Heating	RE163-19	Reduces proposed design hot water use (original proposal reduced use for both standard reference and proposed design, but current 2021 IECC only shows reduction for proposed)	FBC-EC hot water use is currently determined in accordance with ANSI/RESNET/ICC 301 which reduces hot water use even further than this IECC change	2021 IECC does not appear to be written correctly here so difficult to assess	2021 IECC does not appear to be written correctly here so difficult to assess
Table R405.4.2(1) Specifications for the Standard Reference and Proposed Designs: Thermal Distribution	RE172-19	Stipulates the reference design duct location be the same as the proposed design	FBC-EC currently stipulates the reference design duct location to be entirely within the building thermal envelope	Somewhat decreased stringency in most Performance compliance cases	Somewhat decreased cost in most Performance compliance cases

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
Systems					
Table R405.4.2(1) Specifications for the Standard Reference and Proposed Designs: Air Exchange Rate	RE178-19	Clarifies that the reference design mechanical ventilation system type be the same as in the proposed design	Same as change between 2018 IECC and 2021 IECC	None or slightly changed (for Performance projects)	None or slightly changed (for Performance projects)
Table R405.4.2(1) Specifications for the Standard Reference and Proposed Designs: Mechanical Ventilation	RE178-19	Adds "system type" to definition of exhaust fan efficacy term used to calculate annual vent fan energy use as clarification	Same as change between 2018 IECC and 2021 IECC	None likely	None likely
Table R405.4.2(1) Specifications for the Standard Reference and Proposed Designs: Dehumidistat	RE173-19	Adds dehumidistat specifications for the reference and proposed design for proposed designs with mechanical ventilation systems with latent heat recovery	FBC-EC already includes dehumidistat specifications with same reference setpoint (differences include IECC section being specifically for mechanical ventilations systems, and FBC-EC has two dehumidifier reference efficiencies, depending on total capacity, vs. one reference efficiency in the IECC)	None or slightly changed (for applicable Performance projects)	None or slightly changed (for applicable Performance projects)
R405.5 Calculation Software Tools R405.5.1 Minimum Capabilities R405.5.2 Specific Approval R405.5.3 Input Values	Due to CE42-19 Part II	Sections renumbered from R405.6, R405.6.1, R405.6.2 and R405.6.3 due to removal of existing Section R405.3	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
R406.2 ERI Compliance	CE42-19 Part II	Revises existing section text as part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach, and also moves building thermal envelope efficiency requirements to later section	Same as change between 2018 IECC and 2021 IECC	None	None
R406.2 ERI Compliance	RE111-19	Moves the ERI compliance duct insulation requirements from this section to Section R403.3.1	Same as change between 2018 IECC and 2021 IECC	None	None
Table R406.2 Requirements for Total Building Performance	CE42-19 Part II	New table providing the additional requirements for ERI compliance-- part of residential IECC-wide formatting change that removes "mandatory" and "prescriptive" section labels in favor of a tabular approach	Same as change between 2018 IECC and 2021 IECC	None	None
R406.3 Building Thermal Envelope	CE42-19 Part II	New section (and related subsections discussed below) to stipulate building thermal envelope requirements	Same as change between 2018 IECC and 2021 IECC	None	None
R406.3.1 On-site Renewables are Not Included	CE42-19 Part II	New subsection to stipulate building thermal envelope requirements if on-site renewables are not included (note: CE42-19 changes maintain same requirements as previous version, but due to RE150-19, final Section R406.3.1 language does affect stringency)	Same as change between 2018 IECC and 2021 IECC	None	None
R406.3.1 On-site Renewables are Not Included	RE150-19	Replaces building thermal envelope requirements for cases in which on-site renewables are not included with a total building thermal envelope UA	Same as change between 2018 IECC and 2021 IECC	None or slightly changed in some cases (for ERI projects)	Flexibility would allow cost savings in some cases (for ERI projects)

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
		requirement; intended to increase thermal "backstop" flexibility			
R406.3.2 On-site Renewables are Included	CE42-19 Part II	New subsection to stipulate building thermal envelope requirements if on-site renewables are included; requirements are same as previous version	Same as change between 2018 IECC and 2021 IECC	None	None
R406.4 Energy Rating Index	Due to CE42-19 Part II	Section renumbered from R406.3 due to addition of new Section R406.3	Same as change between 2018 IECC and 2021 IECC	None	None
R406.4 Energy Rating Index	RE184-19	Limits reduction in energy use of the rated design due to on-site renewable energy to 5 percent of the total energy use	Same as change between 2018 IECC and 2021 IECC	Increased stringency in applicable ERI project cases	Increased cost in applicable ERI project cases
R406.5 ERI-Based Compliance	Due to CE42-19 Part II	Section renumbered from R406.4 due to addition of new Section R406.3	Same as change between 2018 IECC and 2021 IECC	None	None
R406.5 ERI-based compliance	RE205-19	Added language specifies that both the proposed design and confirmed built dwelling unit be shown to meet ERI requirements	Same as change between 2018 IECC and 2021 IECC	None or slightly increased stringency for ERI projects depending on typical practice	None or slightly increased cost for ERI projects depending on typical practice
Table R406.5 Maximum Energy Rating Index	CE42-19 Part II	Moves footnote "a" regarding on-site renewable energy used for ERI compliance from this table to Section R406.3.2	FBC-EC already addresses on-site renewable energy use in a separate section (R406.2)	None	None
Table R406.5 Maximum Energy Rating Index	RE192-19	Reduces maximum ERI for all Climate Zones; in Florida Climate Zones 1 and 2, reduces maximum IECC ERI from 57 to 52	Would reduce maximum FBC-EC ERI for both Florida Climate Zones from 58 to 52	Increased stringency (for ERI projects)	Increased cost (for ERI projects)
R406.6 Verification by Approved Agency	Due to CE42-19 Part II	Section renumbered from R406.5 due to addition of new Section R406.3	Same as change between 2018 IECC and 2021 IECC	None	None
R406.6 Verification by Approved Agency	RE199-19	Clarifies that verification of the Energy Rating Index is determined by an approved third	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
		party and verification of ERI compliance (mandatory items and maximum ERI score) is completed by the AHJ or an approved third-party inspection agency			
R406.7 Documentation	Due to CE42-19 Part II	Section renumbered from R406.6 due to addition of new Section R406.3	Same as change between 2018 IECC and 2021 IECC	None	None
R406.7.1 Compliance Software Tools	Due to CE42-19 Part II	Section renumbered from R406.6.1 due to addition of new Section R406.3	Same as change between 2018 IECC and 2021 IECC	None	None
R406.7.2 Compliance Report	Due to CE42-19 Part II	Section renumbered from R406.6.2 due to addition of new Section R406.3	Same as change between 2018 IECC and 2021 IECC	None	None
R406.7.2 Compliance Report	RE205-19	Stipulates that compliance documentation be created and submitted for both the proposed design and confirmed built dwelling unit, and moves required information to proposed and confirmed subsections	Same as change between 2018 IECC and 2021 IECC	None or slightly increased stringency for ERI projects depending on typical practice	None or slightly increased cost for ERI projects depending on typical practice
R406.7.2.1 Proposed Compliance Report for Permit Application	RE205-19	RE205-19 breaks out ERI compliance reporting into permit application and certificate of occupancy sections similar to how R405 compliance reporting is organized; new Section R406.7.2.1 provides the ERI permit application reporting requirements	Same as change between 2018 IECC and 2021 IECC	None	None
R406.7.2.2 Confirmed Compliance Report for a Certificate of Occupancy	RE205-19	RE205-19 breaks out ERI compliance reporting into permit application and certificate of occupancy sections similar to how R405 compliance reporting is organized; new Section	Same as change between 2018 IECC and 2021 IECC	None or slightly increased stringency for ERI projects depending on typical practice	None or slightly increased cost for ERI projects depending on typical practice

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
		R406.7.2.2 provides the ERI certificate of occupancy reporting requirements			
R406.7.2.1 Proposed Compliance Report for Permit Application	RE202-19	Requires the ERI proposed compliance report to declare ERI on the title page and on building plans	Same as change between 2018 IECC and 2021 IECC	None	None
R406.7.2.2 Confirmed Compliance Report for a Certificate of Occupancy	RE202-19	Requires the ERI confirmed compliance report to declare ERI on the title page and on building plans	Same as change between 2018 IECC and 2021 IECC	None	None
R406.7.3 Renewable energy certificates (RECs) documentation	RE204-19	New section requires that where onsite renewable energy is included in the calculation of an ERI, the code official must be provided with either 1) substantiation that the associated RECs are owned by, or retired on behalf of, the homeowner, or 2) a contract that conveys the RECs associated with the onsite renewable energy to the homeowner, or conveys an equivalent quantity of RECs associated with other renewable energy to the homeowner	Same as change between 2018 IECC and 2021 IECC	Slight reduction in overall community energy use for applicable ERI projects as these RECs won't be used for offsetting others	Slight increase to cost of PV system for applicable ERI projects as utility or others cannot offset costs by buying RECs
R406.7.4 Additional Documentation	Due to CE42-19 Part II and RE204-19	Section renumbered from R406.6 due to addition of new Sections R406.3 and R406.7.3	Same as change between 2018 IECC and 2021 IECC	None	None
R406.7.5 Specific Approval	Due to CE42-19 Part II and RE204-19	Section renumbered from R406.6 due to addition of new Sections R406.3 and R406.7.3	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
R406.7.6 Input Values	Due to CE42-19 Part II and RE204-19	Section renumbered from R406.6 due to addition of new Sections R406.3 and R406.7.3	Same as change between 2018 IECC and 2021 IECC	None	None
R407 Tropical Climate Region Compliance Path	Unknown (RE15-19?)	New section title for tropical climate region option	Same as change between 2018 IECC and 2021 IECC	None	None
R407.1 Scope	Unknown (RE15-19?)	New scope section for tropical climate region option, but no change in stringency	Same as change between 2018 IECC and 2021 IECC	None	None
R407.2 Tropical Climate Region	Unknown (RE15-19?)	Moves main tropical climate region option language from 2018 IECC Section R401.2.1, but no change in stringency	Same as change between 2018 IECC and 2021 IECC	None	None
R408 Additional Efficiency Package Options	RE209-19	New section title for additional efficiency package options	Same as change between 2018 IECC and 2021 IECC	See Section R408.2	See Section R408.2
R408.1 Scope	RE209-19	New scope section for additional efficiency package options	Same as change between 2018 IECC and 2021 IECC	See Section R408.2	See Section R408.2
R408.2 Additional Efficiency Package Options	RE209-19	New section provides additional efficiency options in subsections listed, used to fulfil Section R401.2.5 additional efficiency requirements	Same as change between 2018 IECC and 2021 IECC	Increased stringency because used in conjunction with Section R401.2.5 additional energy efficiency requirements	Increased cost because used in conjunction with Section R401.2.5 additional energy efficiency requirements
R408.2.1 Enhanced Envelope Performance Option	RE209-19	New section provides enhanced envelope efficiency option that 1) reduces the allowed total building thermal envelope's UA to 95% of the total UA resulting from using Table R402.1.2 *U*-factors, and 2) reduces the allowed average SHGC of glazed fenestration to 95% of the maximum SHGC allowed in Table R402.1.2	Same as change between 2018 IECC and 2021 IECC	Increased stringency because used in conjunction with Section R401.2.5 additional energy efficiency requirements	Increased cost because used in conjunction with Section R401.2.5 additional energy efficiency requirements

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
R408.2.2 More Efficient HVAC Performance Option	RE209-19	New section provides three increased HVAC equipment efficiency options that require increased heating and cooling efficiency	Same as change between 2018 IECC and 2021 IECC	Increased stringency because used in conjunction with Section R401.2.5 additional energy efficiency requirements	Increased cost because used in conjunction with Section R401.2.5 additional energy efficiency requirements
R408.2.3 Reduced Energy Use in Service Water-Heating Option	RE209-19	New section provides three increased service water-heating system efficiency options	Same as change between 2018 IECC and 2021 IECC	Increased stringency because used in conjunction with Section R401.2.5 additional energy efficiency requirements	Increased cost because used in conjunction with Section R401.2.5 additional energy efficiency requirements
R408.2.4 More Efficient Duct Thermal Distribution System Option	RE209-19	New section provides three increased duct system efficiency options (one ductless and two location based)	Same as change between 2018 IECC and 2021 IECC	Increased stringency because used in conjunction with Section R401.2.5 additional energy efficiency requirements	Increased cost because used in conjunction with Section R401.2.5 additional energy efficiency requirements
R408.2.5 Improved Air Sealing and Efficient Ventilation System Option	RE209-19	New section provides air sealing and ventilation efficiency option that includes a maximum air leakage rate of 3.0 ACH50 and ERV or HRV efficiency requirements	Same as change between 2018 IECC and 2021 IECC	Increased stringency because used in conjunction with Section R401.2.5 additional energy efficiency requirements	Increased cost because used in conjunction with Section R401.2.5 additional energy efficiency requirements
Chapter R5: Existing Buildings					
R501.1.1 General	Unknown	2018 IECC Section R501.2 *Existing buildings* text is moved up to this section	FBC-EC already has this text in this section	None	None
R501.2 Compliance	Unknown	2018 IECC Section R501.1.1 *Additions, alterations, or repairs: General* text is moved down to	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
		this section and additional compliance structure is provided			
R502.2 Change in Space Conditioning	Unknown	Moved from Section R503.2 in 2018 IECC, and two existing, related change in space conditioning compliance options (one Total UA and one Performance) are relocated to this section	Same as change between 2018 IECC and 2021 IECC	None	None
R502.3.1 Building Envelope	Unknown	Renumbered section exempts new envelope assemblies from the requirements of Section R402.4.1.2 (air leakage testing)	FBC-EC Section R402.4.1.2 does not require air leakage testing for "additions, alterations, renovations or repairs of the building thermal envelope of existing buildings in which the new construction is less than 85 percent of the building thermal envelope"	None or minor in applicable cases	None or minor in applicable cases
R502.3.2 Heating and Cooling Systems	Unknown	Renumbered Prescriptive compliance section now states "HVAC ducts newly installed as part of an addition…" must comply with Section R403 instead of "New heating, cooling and duct systems that are part of the addition…" must comply with Section R403	Same as change between 2018 IECC and 2021 IECC	Slightly increased stringency in applicable cases	Slightly increased cost in applicable cases
R502.3.2 Heating and Cooling Systems	Unknown	Prescriptive existing system duct testing exception formerly limited to ducts extending less than 40 linear feet in unconditioned spaces now does not include a duct length limit	Same as change between 2018 IECC and 2021 IECC	Slightly reduced stringency in applicable cases	Slightly reduced cost in applicable cases
R503.1 General	RE215-19	Removes redundant language regarding alterations and reorganizes section accordingly	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
R503.1.2 Heating and Cooling Systems	Unknown	Renumbered Prescriptive compliance section now states "HVAC ducts newly installed as part of an alteration…" must comply with Section R403 instead of "New heating, cooling and duct systems that are part of the alteration…" must comply with Section R403	Same as change between 2018 IECC and 2021 IECC	Slightly increased stringency in applicable cases	Slightly increased cost in applicable cases
R503.1.2 Heating and Cooling Systems	Unknown	Prescriptive existing system duct testing exception formerly limited to ducts extending less than 40 linear feet in unconditioned spaces now does not include a duct length limit	Same as change between 2018 IECC and 2021 IECC	Slightly less stringency in applicable cases	Slightly less cost in applicable cases
R503.1.4 Lighting	RE218-19	Reduces alteration lighting efficacy exception from alterations that replace less than 50 percent of the luminaires to those replacing less than 10 percent of the luminaires	Same as change between 2018 IECC and 2021 IECC	Slightly increased stringency in applicable cases	Slightly increased cost in applicable cases
R505.1 General	Unknown	Existing Sections R505.1 addressing change in occupancy is replaced with existing Section R505.2 addressing conversion to a dwelling unit from another use or occupancy	Same as change between 2018 IECC and 2021 IECC	None	None
Chapter R6: Referenced Standards					
ASTM E2178-13: Standard Test Method for Air Permeance of Building Materials	CE19-19 Part II	New air permeance test method standard	Same as change between 2018 IECC and 2021 IECC	None	None
E1827—2011(2017):	ADM47-IRC-19	Updates ASTM E1827-11 to (2017) edition	Would be new referenced standard in FBC-EC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
Standard Test Methods for Determining Airtightness of Building Using an Orifice Blower Door					
ANSI/APSP/ICC 14—2019: American National Standard for Portable Electric Spa Energy Efficiency	ADM47-IRC-19	Updates ANSI/APSP/ICC 14 to 2019 edition	Same as change between 2018 IECC and 2021 IECC	None	None
ANSI/APSP/ICC 15a—2020: American National Standard for Residential Swimming Pool and Spa Energy Efficiency	ADM47-IRC-19	Updates ANSI/APSP/ICC 14 to 2019 edition	Same as change between 2018 IECC and 2021 IECC	None	None
E1554/E1554M-13: Standard Test Methods for Determining Air Leakage of Air Distribution Systems by Fan Pressurization	RE114-19	New air distribution system air leakage test method	Same as change between 2018 IECC and 2021 IECC	None	None
ICC 500-2020: ICC/NSSA Standard for the Design and Construction of Storm Shelters	CE93-19 Part II	New storm shelter design and construction standard	Same as change between 2018 IECC and 2021 IECC	None	None
IEBC-21: International	Unknown	Updates IEBC from 2018 to 2021 edition	FBC-EC does not reference the IEBC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
Existing Building Code					
IFGC-21: International Fuel Gas Code	Unknown	Updates IFGC from 2018 to 2021 edition	FBC-EC does not reference the IFGC	None	None
IMC-21: International Mechanical Code	Unknown	Updates IMC from 2018 to 2021 edition	FBC-EC does not reference the IMC	None	None
IPC-21: International Plumbing Code	Unknown	Updates IPC from 2018 to 2021 edition	FBC-EC does not reference the IPC	None	None
IPMC-21: International Property Maintenance Code	Unknown	Updates IPMC from 2018 to 2021 edition	FBC-EC does not reference the IPMC	None	None
IPSDC-21: International Private Sewage Disposal Code	Unknown	Updates IPSDC from 2018 to 2021 edition	FBC-EC does not reference the IPSDC	None	None
IMC-21: International Residential Code	Unknown	Updates IRC from 2018 to 2021 edition	FBC-EC does not reference the IRC	None	None
NEMA OS 4-2016 Requirements for Air-Sealed Boxes for Electrical and Communication Applications	Unknown	New electrical and communications air-sealed boxes requirements standard	Same as change between 2018 IECC and 2021 IECC	None	None
NFPA 70-20 National Electric Code	Unknown	Updates NFPA 70 from 2017 to 2020 edition	Same as change between 2018 IECC and 2021 IECC	None	None
100—2020: Procedure for Determining Fenestration Products U-factors	ADM47-IPC-19	Updates NFRC 100 from 2017 to 2020 edition	Same as change between 2018 IECC and 2021 IECC	None	None

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
200—2020 Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence	ADM47-IPC-19	Updates NFRC 200 from 2017 to 2020 edition	Same as change between 2018 IECC and 2021 IECC	None	None
400—2020 Procedure for Determining Fenestration Product Air Leakage	ADM47-IPC-19	Updates NFRC 400 from 2017 to 2020 edition	Same as change between 2018 IECC and 2021 IECC	None	None
ANSI/RESNET/ICC 301—2019 Standard for the Calculation and Labeling of the Energy Performance of Dwelling and Sleeping Units using an Energy Rating Index	ADM47-IRC-19	Updates ANSI/RESNET/ICC 301 from 2014 to 2019 edition	FBC-EC already references the 2019 edition	None	None
ANSI/RESNET/ICC 380—2019: Standard for Testing Airtightness of Building, Dwelling Unit and Sleeping Unit Enclosures, Airtightness of Heating and Cooling Air Distribution Systems, and Airflow of	ADM47-IRC-19	Updates ANSI/RESNET/ICC 380 from 2016 to 2019 edition	Same as change between 2018 IECC and 2021 IECC	Slightly improved	Proponent indicates none

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
Mechanical Ventilation Systems					
127—2011 Factory-built Fireplaces—with revisions through July 2016	ADM47-IECC-R-19	Updates UL 127 name and to include revisions through July 2016	Same as change between 2018 IECC and 2021 IECC	None	None
515—2015 Electrical Resistance Heat Tracing for Commercial Applications	ADM47-IECC-R-19	Updates UL 515 from 2011 to 2015 edition	Same as change between 2018 IECC and 2021 IECC	None	None
Appendices					
Appendix RA Board of Appeals	ADM43-19 Part IV	New appendix provides provisions for the establishment of a board of appeals within the jurisdiction to hear applications for modification of the requirements of the code	The Florida Building Commission has no authority to adopt such an appendix as part of the FBC-EC	None	None
Appendix RB Solar-Ready Provisions—Detached One- and Two-Family Dwellings and Townhouses	Due to ADM43-19 Part IV	Moves Solar Ready provisions appendix from "RA" to "RB"	Same as change between 2018 IECC and 2021 IECC	None	None
Appendix RB Solar-Ready Provisions—Detached One- and Two-Family Dwellings and Townhouses: RB103.1 General	RE222-19	Modifies shaded building exception language	Same as change between 2018 IECC and 2021 IECC	None (not mandatory unless adopted by ordinance)	None (not mandatory unless adopted by ordinance)
Appendix RB Solar-Ready Provisions—	RE222-19	New section requires solar-ready zone set back from existing or	Same as change between 2018 IECC and 2021 IECC	None (not mandatory unless	None (not mandatory unless

2021 IECC Section and Title*	ICC Code Change No.	Change Summary b/t 2018 IECC and 2021 IECC	Change Summary b/t 2020 FBC-EC and 2021 IECC	Anticipated Energy Impact on FBC-EC if Adopted	Anticipated Cost Impact on FBC-EC if Adopted
Detached One- and Two-Family Dwellings and Townhouses: RB103.5 Shading		new, permanently affixed objects on the building or site		adopted by ordinance)	adopted by ordinance)
Appendix RB Solar-Ready Provisions—Detached One- and Two-Family Dwellings and Townhouses: RB103.6 Capped Roof Penetration Sleeve	RE222-19	New section provides requirements for capped roof penetration sleeves	Same as change between 2018 IECC and 2021 IECC	None (not mandatory unless adopted by ordinance)	None (not mandatory unless adopted by ordinance)
Appendix RB Solar-Ready Provisions—Detached One- and Two-Family Dwellings and Townhouses: RB103.7, RB103.8, RB103.9 and RB103.10	Due to RE222-19	Sections renumbered due to new Sections RB103.5 and RB103.6	Same as change between 2018 IECC and 2021 IECC	None	None
Appendix RC Zero Energy Residential Building Provisions	RE223-19	New appendix provides provisions for zero energy residential buildings based on Energy Rating Index	Same as change between 2018 IECC and 2021 IECC	None (not mandatory unless adopted by ordinance)	None (not mandatory unless adopted by ordinance)

* Code section numbers in [brackets] are 2018 IECC residential sections that were reed in their entirety in the 2020 IECC.