FSEC Energy Research Center

UNIVERSITY OF CENTRAL FLORIDA

Florida Building Code, Energy Conservation, 7th Edition (2020) vs. 2018 International Energy Conservation Code Residential Stringency Analysis

FSEC-CR-2102-20

DRAFT Final Report

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Disclaimer

Executive Summary

This project was initiated to review residential provisions of the Florida Building Code, Energy Conservation, 7th Edition (2020) (FBC-EC) in order to make a determination if it meets or exceeds the 2018 International Energy Conservation Code (IECC).

This project's code stringency evaluation activities included:

- Reviewing residential provisions of the 2020 FBC-EC and comparing them with residential provisions of the 2018 IECC
- Listing impactful code differences by Mandatory, Prescriptive, Performance and Energy Rating Index categories and providing the anticipated stringency impact for each
- Using EnergyGauge® USA energy modeling software to compare 2018 IECC and 2020 FBC-EC Prescriptive and Performance compliance method stringencies.

The comparison of the 2020 FBC-EC to the 2018 IECC showed a range of stringency impacts, from making the Florida code more stringent to no impact to making the Florida code less stringent. A number of the changes only apply in certain cases such as if a multi-family project, or if certain efficiency credits apply to a project. Two of the most significant changes between the two codes are the increased FBC-EC maximum building air leakage ACH50 and the FBC-EC storage water heater heat trap requirement, the first making the Florida code somewhat less stringent and the second making it slightly more stringent in applicable cases.

Prescriptive and Performance compliance method based simulations were performed for one and two story single-family sample houses and a multi-family unit in three Florida cities representing the two Florida Climate Zones: Miami (Climate Zone 1), Tampa (Climate Zone 2) and Jacksonville (Climate Zone 2). Simulation results showed 2018 IECC Prescriptive compliance to be somewhat more stringent overall than 2020 FBC-EC Prescriptive compliance, but 2018 IECC Performance compliance to be slightly less stringent overall compared with 2020 FBC-EC Performance compliance.

A number of construction type, component and equipment variables enter into an energy code comparison so actual results will depend on the details of the projects eventually built under the new code. However, evaluated as outlined in this report, the 2020 FBC-EC was shown to start to slightly exceed the stringency of the 2018 IECC if 90% or more of compliance is via the Performance method.

Contents

Introduction

This report summarizes the review and evaluation activities carried out to make a determination whether the residential provisions of the 7th Edition (2020) Florida Building Code, Energy Conservation (referred to in this report as the FBC-EC) meet or exceed those of the 2018 International Energy Conservation Code (IECC) code.[1]

Residential code stringency evaluation activities included:

- Reviewing residential provisions of the 2020 FBC-EC and comparing them with residential provisions of the 2018 IECC
- Listing impactful code differences by Mandatory, Prescriptive, Performance and Energy Rating Index sections and providing anticipated stringency impact for each change
- Using EnergyGauge® USA energy modeling software to compare 2018 IECC and 2020 Florida Energy Code Prescriptive and Performance compliance method stringencies.

Impactful Differences between the 2020 FBC-EC and 2018 IECC

A listing of impactful code differences between the 2020 FBC-EC and 2018 IECC is provided below, organized by General, Mandatory, Prescriptive, Performance and Energy Rating Index sections. Anticipated stringency impacts are also provided for each code difference.

Requirements and Compliance Options

Residential Chapter 3 of both the 2020 FBC-EC and 2018 IECC stipulates several general compliance requirements. Residential Chapter 4 of both codes includes additional mandatory requirements that apply to all projects and three compliance method options:

- Sections R401 through R404, commonly referred to as "Prescriptive" option
- Section R405, the "Simulated Performance Alternative" or "Performance" option
- An "Energy Rating Index" or "ERI" approach option in Section R406.

General Requirements

There are a number of Section R303 Materials, Systems and Equipment differences between the 2020 FBC-EC and 2018 IECC. The 2020 FBC-EC adds several requirements to the 2018 IECC insulation requirements including the following.

R303.1.1.1.1

The 2020 FBC-EC includes a subsection regarding insulation *R*-value that is not included in the 2018 IECC:

[1] This report is an update of a 2017 FBC-EC vs. 2015 IECC stringency comparison report; as such, the same or similar discussion language is often used where the differences between these earlier code editions persist.

R303.1.1.1.1 *R*-values referenced in Chapter 4 of this code refer to the *R*-values of the added insulation only. The *R*-values of structural building materials such as framing members, concrete blocks or gypsum board shall not be included.

Exception: R402.1.5 Total UA Alternative.

Depending on common practice, this clarification may make the 2020 FBC-EC slightly more stringent than the 2018 IECC.

R303.2.1 Insulation Installation

The 2020 FBC-EC includes the following section regarding insulation installation that is not included in the 2018 IECC:

R303.2.1 Insulation installation. Insulation materials shall comply with the requirements of their respective ASTM standard specification and shall be installed in accordance with their respective ASTM installation practice in Table R303.2.1 in such a manner as to achieve rated R-value of insulation. Open-blown or poured loose-fill insulation shall not be used in attic roof spaces when the slope of the ceiling is more than three in twelve. When eave vents are installed, baffling of the vent openings shall be provided to deflect the incoming air above the surface of the insulation.

Exception: Where metal building roof and metal building wall insulation is compressed between the roof or wall skin and the structure.

Again depending on common practice, these requirements together with the additional requirements of this section's compressed insulation, substantial contact and insulation protection subsections may make the 2020 FBC-EC slightly more stringent than the 2018 IECC.

Mandatory Requirements

Each 2018 IECC and 2020 FBC-EC compliance option includes mandatory requirements. There are several impactful differences between the 2018 IECC and 2020 FBC-EC mandatory requirements.

R402.4.1.2 Testing

Section R402.4.1.2 from the 2020 FBC-EC below shows the building testing language changes from the 2018 IECC in strike-out and underline format:

R402.4.1.2 Testing.
The building or dwelling unit shall be tested and verified as having an air leakage rate not exceeding ~~five~~ seven air changes per hour in Climate Zones 1 and 2, and three air changes per hour in Climate Zones 3 through 8. Testing shall be conducted in accordance with ~~RESNET/ICC 380, ASTM E 779 or ASTM E 1827~~ANSI/RESNET/ICC 380 and reported at a pressure of 0.2 inch w.g. (50 Pascals). ~~Where required by the *code official,*~~ Testing shall be conducted by either individuals as defined in Section

553.993(5) or (7), Florida Statutes or individuals licensed as set forth in Section 489.105(3)(f), (g), or (i) or an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official.* Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope.* [no change to remaining text in section]

Changing the maximum leakage rate from five air changes per hour (ACH50 = 5) to seven changes per hour (ACH50 = 7) in Climate Zones 1 and 2 (all of Florida) results in the 2020 FBC-EC being somewhat less stringent than the 2018 IECC. This modification is however due to 2016 Florida legislation which required the change in response to homebuilders concerns regarding tight houses without reliable mechanical ventilation systems.

As also shown above, the 2018 IECC continues to allow the requirement for tester approval to be at the discretion of the code official. This difference may result in the 2020 FBC-EC being slightly more stringent in some cases (depending on typical practice).

An additional Florida change provides an exception to the Section R402.4.1.2 testing requirement:

> EXCEPTION: Testing is not required for additions, alterations, renovations, or repairs, of the building thermal envelope of existing buildings in which the new construction is less than 85% of the building thermal envelope.

This change should continue to help clarify testing requirements and slightly reduce the amount of testing required in the state, but little or no stringency impact is anticipated.

R402.4.2 Fireplaces

A Section R402.4.2 change between the 2015 IECC and 2018 IECC removed a UL 907 listing and labeling requirement for the doors of masonry fireplaces. The rationale provided for the change was in part that "according to testing laboratories, there is no way to test to that standard," so as a result, keeping the standard "will actually limit, or possibly eliminate, the installation of doors." The 2020 FBC-EC still includes the UL 907 listing and labeling requirement. Based on the rationale provided, this 2018 IECC change could make it slightly more stringent than the 2020 FBC-EC in applicable cases.

R403.3.2 Sealing

Section R403.3.2 from the 2020 FBC-EC below shows the 2018 IECC duct sealing language again with Florida changes shown in strike-out and underline format:

> **R403.3.2 Sealing (Mandatory).** All d~~D~~ucts, air handlers, ~~and~~ filter boxes and building cavities that form the primary air containment passageways for air distribution systems shall be ~~sealed~~ considered ducts or plenum chambers, shall be constructed and sealed in accordance with Section C403.2.9.2 of the Commercial Provisions of this code and shall be shown to meet duct tightness criteria below.

~~Joints and seams shall comply with either the *International Mechanical Code* or *International Residential Code,* as applicable.~~
Duct tightness shall be verified by testing in accordance with ANSI/RESNET/ICC 380 by either individuals as defined in Section 553.993(5) or (7), *Florida Statutes*, or individuals licensed as set forth in Section 489.105(3)(f), (g), or (i), *Florida Statutes*, to be "substantially leak free" in accordance with Section R403.3.3.

While the 2020 FBC-EC has a number of changes to this section, most will either have limited impact on stringency, or the impact would be difficult to assess without long-term field data.

R403.3.3 Duct Testing

Exceptions to the 2020 FBC-EC Section R403.3.3 Duct Testing section are provided below with 2020 FBC-EC changes to the 2018 IECC shown in strike-out and underline format:

Section R403.3.3 Duct testing (Mandatory). [No change to text]

Exceptions:

1. A duct air leakage test shall not be required where the ducts and air handlers are located entirely within the building thermal envelope.
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.~~
2. Duct testing is not mandatory for buildings complying by Section R405 of this code. Duct leakage testing is required for Section R405 compliance where credit is taken for leakage, and a duct air leakage Qn to the outside of less than 0.080 (where Qn = duct leakage to the outside in cfm per 100 square feet of conditioned floor area tested at 25 Pascals) is indicated in the compliance report for the *proposed design*.

Struck-out Exception 2 above regarding heat and energy recovery ventilators is a clarification in the 2018 IECC; as such, it is not a change in code stringency. Underlined Exception 2 is an additional Florida duct testing exception that only applies to Section R405 of the code (Performance compliance), so it does not affect Prescriptive compliance stringency. Performance compliance implications are discussed in the Performance Compliance section below.

R403.3.6 Ducts buried within ceiling insulation

The 2018 IECC includes a new section regarding supply and return air ducts that are partially or completely buried in ceiling insulation along with a new subsection that stipulates an effective duct insulation *R*-value of R-25 be used for performance simulations for deeply buried ducts that meet certain placement and insulation conditions. Buried ducts language code modifications were submitted for the FBC-EC, but none were finally approved. Little or no stringency impact is anticipated from these changes.

R403.3.7 Ducts located in conditioned space

The 2018 IECC includes a new section that specifies two separate conditions under which ducts are considered as being inside conditioned space:

1. Duct systems that are "located completely within the continuous air barrier and within the building thermal envelope"
2. Buried ducts that meet specified air handler location (within the continuous air barrier and building thermal envelope), duct leakage, and ceiling insulation R-value requirements.

Regarding the first condition, ducts that are completely within the continuous air barrier and building thermal envelope may still be in an unconditioned space such as a sealed attic. Duct work in sealed attics typically experiences summer afternoon temperatures about 5°F higher than conditioned space temperatures,[2] so the specified condition is not equivalent to being inside conditioned space. The second condition is also not seen as being equivalent to being inside conditioned space. So this change makes the 2018 IECC slightly less stringent than the 2020 FBC-EC in cases where it is used for compliance.

R403.5.5 Heat Traps

Section R403.5 of the 2020 FBC-EC requires heat traps for storage water heaters:

> **R403.5.5 Heat traps (Mandatory).** Storage water heaters not equipped with integral heat traps and having vertical pipe risers shall have heat traps installed on both the inlets and outlets. External heat traps shall consist of either a commercially available heat trap or a downward and upward bend of at least 3½ inches (89 mm) in the hot water distribution line and cold water line located as close as possible to the storage tank.

This heat trap requirement increases Florida Prescriptive, Performance and ERI compliance stringency slightly relative to the 2018 IECC in applicable cases.

R403.7.1 Equipment sizing

Subsections under 2020 FBC-EC Section R403.7 provide additional cooling and heating system sizing requirements and exceptions that are not included in the 2018 IECC system sizing section. Depending on typical practice, it is anticipated that these additions will slightly increase the stringency of the 2020 FBC-EC relative to the 2018 IECC.

[2] Parker, D., J. Sonne, and J. Sherwin. 2002. Comparative Evaluation of the Impact of Roofing Systems on Residential Cooling Energy Demand in Florida. Proceedings of ACEEE 2002 Summer Study, American Council for an Energy Efficient Economy, Washington, DC; https://www.fsec.ucf.edu/en/publications/pdf/FSEC-CR-1220-00.pdf

R403.10.3 Covers

A 2018 IECC change increases from 70% to 75% the heated pool and outdoor permanent spa heating energy that must come from a heat pump or on-site renewable energy to exempt the pool or spa from the cover requirement. The 2018 IECC also specifies the 75% heat pump or on-site renewable heating energy must be computed over an operation season of not less than three calendar months. These change make the 2018 IECC slightly more stringent than the 2020 FBC-EC in applicable cases.

R403.13 Dehumidifiers

New 2020 FBC-EC Section R403.13 provides minimum efficiency, control, insulation and condensate disposal requirements for dehumidifiers (only applicable if dehumidifiers are installed):

> **R403.13 Dehumidifiers (Mandatory).** If installed, a dehumidifier shall conform to the following requirements:
>
> 1. The minimum rated efficiency of the dehumidifier shall be greater than 1.7 liters/ kWh if the total dehumidifier capacity for the house is less than 75 pints/day and greater than 2.38 liters/kWh if the total dehumidifier capacity for the house is greater than or equal to 75 pints/day.
> 2. The dehumidifier shall be controlled by a sensor that is installed in a location where it is exposed to mixed house air.
> 3. Any dehumidifier unit located in unconditioned space that treats air from conditioned space shall be insulated to a minimum of R-2.
> 4. Condensate disposal shall be in accordance with Section M1411.3.1 of the Florida Building Code, Residential.

An additional new FBC-EC subsection, R403.13.1, provides configuration and insulation requirements for ducted dehumidifiers. Depending on typical practice, in applicable cases, these changes together should increase the stringency of the 2020 FBC-EC slightly relative to the 2018 IECC.

R404.1 Lighting equipment

A 2020 FBC-EC change replaces the Definitions section defined "high-efficacy" term with minimum lumens per watt efficacy specifications and increases the percentage of permanently installed lamps that must have these minimum efficacies from 75% to 90%. The 2018 IECC also has a 90% high efficacy requirement but keeps the high-efficacy definition. The net result of these changes is that there is now very little difference in lighting stringency between the 2020 FBC-EC and 2018 IECC.

Other Mandatory Changes

There are several additional Mandatory differences between the 2020 FBC-EC and the 2018 IECC which either do not directly affect stringency or the impact of which would be difficult to determine, such as the Section R402.4 FBC-EC exception that allows R-2 Occupancies and multiple attached single family dwellings to comply with commercial code air leakage testing requirements.

Prescriptive Compliance

Section R402 of the 2018 IECC and 2020 FBC-EC provides residential building thermal envelope requirements for prescriptive compliance centered around component efficiencies listed in Tables R402.1.2 and R402.1.4.

Table R402.1.2 Insulation and Fenestration Requirements by Component

Section R402 Table R402.1.2 "Insulation and Fenestration Requirements by Component" of the 2018 IECC provides specific requirements by building component together with clarifying notes:

TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5[h]	8/13	19	10 /13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5[h] or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5[h] or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

NR = Not Required.

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall.
"15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

While only Climate Zones 1 and 2 of Table R402.1.2 apply to Florida, the 2020 FBC-EC also includes this entire table, with no substantive Florida changes except the addition of note "j":

j. For impact rated fenestration complying with Section R301.2.1.2 of the *Florida Building Code, Residential* or Section 1609.1.2 of the *Florida Building Code, Building* the maximum *U*-factor shall be 0.65 in Climate Zone 2.

In allowing a maximum Climate Zone 2 U-factor of 0.65 for impacted rated fenestration vs. the 2018 IECC's 0.4 value which does not differentiate for impact fenestration, the note "j" change decreases 2020 FBC-EC Prescriptive compliance stringency slightly in applicable cases relative to the 2018 IECC.

<u>Table R402.1.4 Equivalent U-Factors</u>

Table R402.1.4 "Equivalent *U*-Factors" of the 2018 IECC provides assembly *U*-factors for a number of components that can be used as alternatives to *R*-value requirements in Table R402.1.2:

TABLE R402.1.4
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.030	0.084	0.165	0.064	0.360	0.477
3	0.32	0.55	0.030	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.32	0.55	0.026	0.060	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.026	0.060	0.082	0.033	0.050	0.055
6	0.30	0.55	0.026	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	0.026	0.045	0.057	0.028	0.050	0.055

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.

b. Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.

c. In warm-humid locations as defined by Figure R301.1 and Table R301.1, the basement wall *U*-factor shall not exceed 0.360.

Only Climate Zones 1 and 2 of Table R402.1.4 apply to Florida, but the 2020 FBC-EC again includes the entire table, with only slight wording changes (no stringency differences) compared with the 2018 IECC version of the table.

<u>R402.2.2 Ceilings without attic spaces</u>

The 2018 IECC adds a stipulation for ceilings without attic spaces that also do not have sufficient space for otherwise required above R-30 insulation, that requires insulation to extend over the top of the wall plate to the outer edge of the plate and not be compressed. This change makes the 2018 IECC slightly more stringent than the 2020 FBC-EC in applicable Prescriptive compliance cases.

<u>Table R402.2.6 Steel-Frame Ceiling, Wall and Floor Insulation R-values</u>

A 2018 IECC change removes the R-19 + 2.1, 16" on center, steel frame wall R-13 wood frame equivalence option from Table R402.2.6. This change makes the 2018 IECC slightly more stringent than the 2020 FBC-EC in applicable Prescriptive compliance cases.

R403.3.6 Air Handling units

The 2020 FBC-EC includes Section R403.3.6 which prohibits the installation of air handlers in attics for prescriptive compliance:

> **R403.3.6 Air-handling units.** Air handling units shall not be installed in the attic when a home is brought into code compliance by Section R402. …

There are a number of new homes, particularly in South Florida, where installing air handlers in the attic is common. While the number of air handlers that would have been installed in attics in Florida without this code section cannot be known, this section makes 2020 FBC-EC Prescriptive compliance more stringent than 2018 IECC Prescriptive compliance.

R403.7.2. Electric space heating

A 2020 FBC-EC change prohibits electric resistance space heating from being the primary heating system used in Climate Zone 2 for Prescriptive compliance. This change will make the FBC-EC more stringent than the 2018 IECC in applicable cases.

Performance Compliance

Section R405 of the 2018 IECC and 2020 FBC-EC provides a Simulated Performance Alternative, or "Performance" compliance option that compares heating, cooling and water heating energy costs (IECC) or annual loads (FBC-EC) for a proposed project building with those of a reference building of the same size. The 2020 FBC-EC includes a number of Performance compliance differences from the 2018 IECC.

R405.2.1 Ceiling insulation

The 2020 FBC-EC includes Section R405.2.1 which requires minimum Performance ceiling insulation levels:

> **R405.2.1 Ceiling insulation.** Ceilings shall have an insulation level of at least R-19, space permitting. For the purposes of this code, types of ceiling construction that are considered to have inadequate space to install R-19 include single assembly ceilings of the exposed deck and beam type and concrete deck roofs. Such ceiling assemblies shall be insulated to at least a level of R-10.

While this subsection means only the Florida code has a Performance compliance ceiling insulation minimum, since both the Florida and IECC Performance compliance methods maintain a set overall efficiency requirement, it does not increase the stringency of the FBC-EC relative to the IECC.

R405.2.2 Building air leakage testing

The 2020 FBC-EC includes new Section R405.2.2 which clarifies Performance compliance building air leakage rate limits:

> **R405.2.2 Building air leakage testing.** Building or dwelling air leakage testing shall be in accordance with Sections R402.4 through R402.4.1.2. If an air leakage rate below seven air changes per hour at a pressure of 0.2 inch w.g. (50 Pascals) is specified for the *proposed design*, testing shall verify the air leakage rate does not exceed the air leakage rate of the *proposed design* instead of seven air changes per hour.

Based on anecdotal evidence of typical practice and enforcement, this change should slightly increase the stringency of the 2020 FBC-EC compared with the 2018 IECC.

R405.2.3 Duct air leakage testing

The 2020 FBC-EC includes new Section R405.2.3 which clarifies when Performance compliance duct air leakage testing is required, and in cases where testing is required, that the maximum leakage rate allowed is the leakage value entered for the *proposed design*:

> **R405.2.3 Duct air leakage testing.** In cases where duct air leakage lower than the default Qn to outside of 0.080 (where Qn = duct leakage to the outside in cfm per 100 square feet of conditioned floor area tested at 25 Pascals) is specified for the *proposed design*, testing in accordance with Section R403.3.2 shall verify a duct air leakage rate not exceeding the leakage rate of the *proposed design*. Otherwise, in accordance with Section R403.3.3, duct testing is not mandatory for buildings complying by Section R405.

Based on anecdotal evidence of typical practice and enforcement, this change should slightly increase the stringency of the 2020 FBC-EC compared with the 2018 IECC.

R403.3.3 Duct Testing

As shown above in the Mandatory Requirements section of this report, an exception added to Section R403.3.3 of the FBC-EC allows compliance via the Performance method without duct leakage testing, regardless of whether the ducts are in conditioned space or not. While this exception allows leakier ducts for Florida Performance compliance, since there is a non-tested "default leakage penalty" built into the calculation and again the Performance compliance method maintains a set overall efficiency requirement, it does not make the 2020 FBC-EC less stringent than the 2018 IECC.

R405.3 Performance-based Compliance

Section R405.3 differences between the 2020 FBC-EC and 2018 IECC address how performance compliance is calculated and include a FBC-EC reference to Appendix RC that provides calculation details (FBC-EC changes to the 2018 IECC shown here in strike-out and underline format):

> **R405.3 Performance-based compliance.** Compliance based on simulated energy performance requires that a proposed residence (*proposed design)* be shown to have ~~an~~ annual ~~energy cost~~ <u>total normalized Modified Loads</u> that ~~is~~ <u>are</u> less than or

equal to the annual ~~energy cost~~ total loads of the *standard reference design* as calculated in accordance with Appendix RC of this standard. ~~Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's *State Energy Data System Prices and Expenditures Report. Code officials* shall be permitted to require time-of-use pricing in energy cost calculations.~~

~~**Exception:** The energy use based on source energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the energy cost. The source energy multiplier for electricity shall be 3.16. The source energy multiplier for fuels other than electricity shall be 1.1.~~

While these changes stipulate a significant difference in how the 2020 FBC-EC calculates performance compliance compared with the 2018 IECC, this difference also exists in the current 2017 FBC-EC and has historically still provided similar stringencies. An analysis of 2020 FBC-EC vs. 2018 IECC Performance compliance stringency is provided below in the Prescriptive and Performance Compliance Simulations section of this report.

R405.4.2 Compliance report

The 2018 IECC allows batch compliance sampling for stacked multiple-family units. This change reduces the stringency of IECC Performance compliance compared to the 2020 FBC-EC in applicable cases.

Table R405.5.2(1) Specifications for the Standard Reference and Proposed Designs

Both the 2020 FBC-EC and 2018 IECC provide Performance compliance Standard Reference and Proposed Design specifications in Table R405.5.2(1). Differences in these specifications between the two codes are discussed individually below.

Table R405.5.2(1) Skylight Reference

In cases where the Proposed Design will include one or more skylights, the 2020 FBC-EC Performance compliance method includes a skylight for the Standard Reference Design (changes from the 2018 IECC shown in strike-out and underline format):

	~~None~~ Skylight area= (a) The proposed skylight area (ASKY), where the proposed total fenestration area (AF) is less than 15 percent of the conditioned floor area (CFA), or (b) The adjusted skylight area ($ASKY_{adj}$), where AF is 15 percent or more of CFA. $ASKY_{adj}$ shall be calculated as follows: $ASKY_{adj} = ASKY \cdot 0.15 \cdot CFA/AF$	As proposed
	Orientation: as proposed	As proposed

Skylights	*U*-factor: as specified in Table R402.1.4	As proposed
	SHGC: as specified by the exception in footnote (b) of Table R402.1.2, except that for climate zones with no requirement (NR) SHGC = 0.40 shall be used	As proposed
	Interior shade fraction for the area of proposed skylights equipped and rated with factory-installed interior shades, the interior shade fraction is: 0.92 - (0.21 · SHGC) [SHGC as above for the standard reference design]	As proposed, with shades assumed closed 50% of the daylight hours
	External shading: none	As proposed

Adding Reference skylight area for projects with Proposed skylights increases the Florida Reference cooling load, decreasing the stringency of the 2020 FBC-EC relative to the 2018 IECC in applicable cases.

Table R405.5.2(1) Air Exchange Rate

The 2020 FBC-EC changes the Standard Reference Design air leakage rate to ACH50 = 7 from ACH50 = 5 in the 2018 IECC. Changes from the 2018 IECC are shown in strike-out and underline format:

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air exchange rate	~~The ~~Air leakage rate of 7.00 air changes per hour in Climate Zones 1 and 2, and 3 air changes per hour in Climate Zones 3 through 8 at a pressure of 0.2 inch w.g. (50 Pa). ~~shall be~~ ~~*Climate Zones* 1 and 2: 5 air changes per hour.~~ ~~*Climate Zones* 3 through 8: 3 air changes per hour.~~ The mechanical ventilation rate shall be in addition to the air leakage rate and ~~shall be~~ the same as in the proposed design, but no~~t~~ greater than $0.01 \times CFA + 7.5 \times (N_{br} + 1)$ where: *CFA* = conditioned floor area, ~~ft^2~~. N_{br} = number of bedrooms~~.~~ Energy recovery shall not be assumed for mechanical ventilation.	The measured air exchange rate[a]. The mechanical ventilation rate[b] shall be in addition to the air leakage rate and shall be as proposed.

This reference air leakage rate change increases the Florida Reference cooling and heating loads, so decreases the stringency of the 2020 FBC-EC relative to the 2018 IECC. The impact of this change is included below in the Prescriptive and Performance Compliance Simulations section of this report.

Table R405.5.2(1) Dehumidification Systems and Dehumidistat

The 2020 FBC-EC includes new Standard Reference Design and Proposed Design Dehumidification Systems and Dehumidistat specifications (related to mandatory Section R403.13 discussed above) which are not included in the 2018 IECC:

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Dehumidification Systems	None, except where dehumidification equipment is specified by the proposed design, in which case: Fuel Type: electric Capacity: sufficient to maintain humidity at setpoint all hours Efficiency: 1.7 liters/kWh if proposed house total capacity is less than 75 pints/ day; 2.38 liters/kWh if proposed house total capacity is greater than or equal to 75 pints per day Location: in conditioned space Dehumidifier Ducts: None Dehumidifier Duct Location: N/A Dehumidifier Duct *R*-Value: N/A Dehumidifier Duct Surface Area: N/A	As proposed As proposed Sufficient to maintain humidity at setpoint all hours As proposed As proposed As proposed As proposed As proposed As proposed
Dehumidistat	None, except where dehumidification equipment is specified by the proposed design, in which case: Setpoint turn on = 60% relative humidity Setpoint turn off = 55% relative humidity	Same as standard reference design

Depending on typical practice, these changes should increase the stringency of the 2020 FBC-EC slightly relative to the 2018 IECC in applicable cases.

Table R405.5.2(1) Equipment Efficiency Changes

Consistent with its previous edition, Table R405.5.2(1) of the 2018 IECC stipulates that the Standard Reference Design's space heating system, cooling system and service water heating efficiencies be the same as the efficiencies of the Proposed Design. The 2020 FBC-EC, also consistent with the previous edition of this code, instead stipulates Standard Reference Design heating, cooling and water heating efficiencies to be "in accordance with prevailing Federal minimum standards." This difference in effect means that while both the IECC and FBC-EC Performance compliance methods allow a number of component efficiency "trade-offs," the IECC does not include equipment efficiency trade-off options while the FBC-EC does include equipment efficiency trade-offs. Since however both codes' Performance compliance methods again maintain a set overall efficiency requirement, this difference will not make the 2020 FBC-EC less stringent than the 2018 IECC.

Table R405.5.2(1) Service Water Heating

The 2020 FBC-EC changes the service water heating Standard Reference Design and Proposed Design use and energy consumption specifications to be determined according to ANSI/RESNET/ICC Standard 301. Changes from the 2018 IECC are shown in strike-out and underline format:

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Service water heating[d, e, f, g]	Fuel type: As proposed~~.~~ Use (gal/day): determined in accordance with ANSI/RESNET/ICC 301~~same as proposed design~~. Efficiency: in accordance with prevailing federal minimum standards Energy consumption: determined in accordance with ANSI/RESNET/ICC 301	Fuel type: As proposed Use~~, in units of~~ gal/day = determined in accordance with ANSI/ RESNET/ICC 301 ~~30 + (10 × *Nbr*)~~ ~~where:~~ ~~*Nbr* = number of bedrooms.~~ Efficiency: as proposed Energy consumption: determined in accordance with ANSI/RESNET/ICC 301

The stringency impact of these 2020 FBC-EC service water heating changes will be minimal for a base code storage type system, and will vary for other system types and measures (e.g. tankless systems, heat pumps, systems with recirculation, and systems with pipe insulation and reduced pipe length). Detailed impacts are discussed in the Florida Building Commission funded research report *Improved Hot Water Code Calculation.*[3]

Table R405.5.2(1) Thermal Distribution Systems

Differences between the 2020 FBC-EC and 2018 IECC thermal distribution systems Standard Reference Design and Proposed Design specifications are shown below (changes from the 2018 IECC are shown in strike-out and underline format):

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Thermal distribution systems	Duct insulation: R-6 ~~in accordance with Section R403.3.1.~~ ~~A thermal~~ D~~d~~istribution system efficiency: ~~(DSE) of~~ 0.88 ~~shall be applied to both the heating and cooling system efficiencies for all systems other than tested duct systems.~~ ~~**Exception:** For nonducted heating and cooling systems that do not have a fan, the standard reference design thermal distribution system efficiency (DSE) shall be 1.~~ ~~For tested duct systems, the leakage rate shall be 4 cfm (113.3 L/min) per 100 ft² (9.29 m2) of *conditioned floor area* at a pressure of differential of 0.1 inch w.g. (25 Pa).~~ Duct location: entirely within the building thermal envelope Air handler location: entirely within the building thermal envelope	~~Duct insulation:~~ A~~a~~s proposed~~.~~ Thermal distribution system efficiency shall be ~~A~~as tested in accordance with ANSI/RESNET/ICC 380 or~~,~~ if ~~where~~ not tested, shall be modeled as a Qn to outside of 0.080 for ducted systems. Hydronic and ductless systems shall be as specified in Table R405.5.2(2) if not tested. As proposed As proposed

[3] https://publications.energyresearch.ucf.edu/wp-content/uploads/2018/06/FSEC-CR-2066-17.pdf

The Standard Reference Design duct insulation level difference results in the 2018 IECC being slightly more stringent for most projects with attic ducts. The Reference distribution system efficiency (DSE) for projects with non-tested duct systems is 0.88 in both codes, so since the majority of Florida projects comply with non-tested ducts, there is no DSE stringency difference between the two codes in most cases. The FBC-EC Proposed Design Qn to outside requirement should match the 0.88 DSE typically but allows for credit/reduction for heat loss and gain based on duct location and attic configuration and also allows for consistent results between planned projects and fully tested projects. Field testers know the target they are trying to hit.

Table R405.5.2(1) Footnote "a"

Consistent with Section R402.4.1.2 and as discussed above in the Mandatory Requirements section, Table R405.5.2(1) footnote "a" in the 2018 IECC continues to allow the requirement for approved building air leakage testers to be at the discretion of the code official. This difference may result in the 2020 FBC-EC being slightly more stringent in some cases, depending on typical practice.

Table R405.5.2(1) Footnote "e"

The 2020 FBC-EC Table R405.5.2(1) footnote "e" adds a clarification for how projects without proposed heating systems should be handled (clarification text added in the 2020 FBC-EC is underlined):

> e. For a proposed design without a proposed heating system, a heating system with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design and this heating system shall be an electric heat pump if the proposed design has an electric water heater.

Since this clarification applies to both the Standard Reference Design and Proposed Design equally, stringency impacts, if any, will be relatively minor.

Table R405.5.2(1) Footnote "h" [Regarding Multi-family Projects]

The 2020 FBC-EC increases the Standard Reference Design's multi-family fenestration area adjustment backstop value in footnote "h" from 0.56 in the 2018 IECC to 0.80. In applicable multi-family cases, this backstop increase in turn increases the Reference Design's fenestration area, decreasing the stringency of the 2020 FBC-EC relative to the 2018 IECC.

R405.5.3 Calculation requirements for glazing

The 2020 FBC-EC includes Section R405.5.3 which provides additional Performance compliance window and door calculation clarifications, including window area measurement requirements, a window area exception for additions, overhang measurement details, and specifications for how doors with glazing are to be handled. Each subsection is discussed below. A parallel to FBC-EC Section R405.5.3 is not included in the 2018 IECC except as detailed below, IECC Section R402.5 also addresses maximum fenestration SHGC.

R405.5.3.1 Glass Areas
The 2020 FBC-EC includes Section R405.5.3.1 regarding glass area:

> **R405.5.3.1 Glass areas.** All glazing areas of a residence, including windows, sliding glass doors, glass in doors, skylights, etc. shall include the manufacturer's frame area in the total window area. Window measurements shall be as specified on the plans and specifications for the residence.
>
> > **Exception:** When a window in existing exterior walls is enclosed by an addition, an amount equal to the area of this window may be subtracted from the glazing area for the addition for that overhang and orientation.

Depending on typical practice, the stipulation to include the manufacturer's frame area in the total window area may increase the stringency of the 2020 FBC-EC slightly relative to the 2018 IECC. In the case of applicable additions, the exception included with this subsection will slightly decrease the stringency of the FBC-EC relative to the IECC.

R405.5.3.2 Overhangs
The 2020 FBC-EC includes Section R405.5.3.2 regarding window overhangs:

> **R405.5.3.2 Overhangs.** Overhang effect is measured by Overhang Separation, which is the vertical measure of the distance from the top of a window to the bottom of the overhang. The overhang for adjustable exterior shading devices shall be determined at its most extended position. Nonpermanent shading devices such as canvas awnings shall not be considered overhangs. Permanently attached wood and metal awnings may be considered overhangs.

Depending on typical practice, the overhang stipulations included in this subsection may increase the stringency of the 2020 FBC-EC slightly relative to the 2018 IECC.

R405.5.3.3 Doors with glazing
One potentially impactful glazing related difference between the 2020 FBC-EC and 2018 IECC stems from a new IECC Chapter 2 addition that defines an opaque door as "a door that is not less than 50 percent opaque in surface area." Section R405.5.3.3 of the FBC-EC on the other hand states:

> **R405.5.3.3 Doors with glazing.** For doors that are opaque or where the glass is less than one-third of the area of the door, the total door area shall be included in the door calculation. For unlabeled sliding glass doors or when glass areas in doors are greater than or equal to one-third of the area of the door, the glazing portion shall be included in the glazing calculation and the opaque portion of the door shall be included in the door calculation. When glass areas in doors are greater than or equal to one-third of the area of the door, the door shall be included in the glazing

> calculation as a total fenestration using the tested U-factor and solar heat gain coefficient.

These differences between the FBC-EC and IECC may result in homes with French doors (which are often around 50% opaque and 50% transparent) to be treated differently by the two codes, in some cases resulting in the 2018 IECC being somewhat less stringent than the 2020 FBC-EC.

R405.5.3.4 Maximum Fenestration SHGC

The 2020 FBC-EC includes Section R405.5.3.4 regarding maximum fenestration SHGC and overhang depth:

> **R405.5.3.4 Maximum fenestration SHGC.** The Proposed Design must have either an area-weighted average maximum fenestration SHGC of 0.50 or a window area-weighted average overhang depth of 4.0 feet or greater (all conditioned space windows must be included in the calculation). The area-weighted average maximum fenestration U-factor permitted using tradeoffs from Section R402.1.4 or R405 shall be 0.48 in Climate Zones 4 and 5 and 0.40 in Climate Zones 6 through 8 for vertical fenestration, and 0.75 in Climate Zones 4 through 8 for skylights. The area-weighted average maximum fenestration SHGC permitted using tradeoffs from Section R405 in Climate Zones 1 through 3 shall be 0.50.

Section R402.5 of the 2018 IECC also includes a Climate Zones 1 through 3 area-weighted average maximum fenestration SHGC of 0.50. The 2020 FBC-EC moves this requirement to the Performance compliance section of the code and adds the four foot overhang depth alternative to the SHGC requirement. The Florida overhang exception will apply to a limited number of projects and its effect on stringency will depend on project details, but on average is expected to be minimal.

R405.6.3.1 Water Heating EF Adjustment Factors

The 2020 FBC-EC includes Section R405.6.3.1 regarding Energy Factor (EF) adjustments for instantaneous water heaters:

> **R405.6.3.1 Water Heating EF adjustment factors.** The Energy Factor (EF) of an instantaneous water heater (those with capacity of two gallons (7.57 L) or less) in the Proposed home shall be reduced to 92% of the value in the manufacturer's documentation or AHRI *Directory of Certified Product Performance*.

In applicable instantaneous water heater cases, this change will increase the stringency of the 2020 FBC-EC relative to the 2018 IECC.

R405.7 Performance Compliance Credit Option Criteria

Section R405.7 of the 2020 FBC-EC includes criteria for six Performance compliance credit options: attic radiant barriers and interior radiation control coatings, cool roofs, cross ventilation, whole house fans, ceiling fans and heat recovery units.[4] IECC Performance compliance also allows most of these credits, but does not include the compliance criteria stipulated for them in the FBC-EC. So depending on typical practice, these criteria may slightly increase the stringency of the 2020 FBC-EC compared to the 2018 IECC.

Energy Rating Index Compliance

Section R406 of the 2018 IECC and 2020 FBC-EC provides an Energy Rating Index or "ERI" compliance alternative that adds appliances and lighting to the heating, cooling and water heating loads included in Performance (R405) compliance calculations. The 2020 FBC-EC includes several ERI compliance changes from the 2018 IECC.

R406.2 Mandatory Requirements

Section R406.2 of both the 2020 FBC-EC and 2018 IECC specifies mandatory efficiency requirements for ERI projects. The FBC-EC version of this section also specifies more stringent minimum efficiency requirements for projects that utilize on-site renewable power production for ERI compliance. Since however the IECC also has the same more stringent efficiency requirements for projects that utilize on-site renewables for compliance in footnote "a" of Table R406.4, there is no stringency difference between the two codes in these cases.

R406.3 Energy Rating Index

Section R406.3 Energy Rating Index differences between the 2020 FBC-EC and 2018 IECC are as shown here (changes from the 2018 IECC are shown in strike-out and underline format):

> **R406.3 Energy Rating Index.** The Energy Rating Index (ERI) shall be a numerical integer value that is based on a linear scale constructed such that the *ERI reference design* has an Index value of 100 and a *residential building* that uses no net purchased energy has an Index value of 0. Each integer value on the scale shall represent a 1-percent change in the annual total normalized modified loads of the *rated design* relative to the annual total loads of the *ERI reference design*. The ERI shall consider all energy used in the *residential building*. ~~determined in accordance with RESNET/ICC 301 except for buildings covered by the *International Residential Code*, the ERI Reference Design Ventilation rate shall be in accordance with Equation 4-1.~~
>
> ~~Ventilation rate, CFM = (0.01 × total square foot area of house) + [7.5 × (number of bedrooms + 1)] (Equation 4-1)~~

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[4] This section of the 2020 FBC-EC also provides criteria for unvented attics, but the 2018 International Residential Code includes similar criteria which would apply to 2018 IECC compliance.

Energy used to recharge or refuel a vehicle for on-road (and off-site) ~~used for~~ transportation purposes ~~on roads that are not on the building site~~ shall not be included in the *ERI reference design* or the *rated design*.

These differences eliminate the Equation 4-1 exception which has been interpreted differently by various building scientists. It is difficult to assess the stringency impact of the difference between these versions.

Table R406.4 Maximum Energy Rating Index

The 2020 FBC-EC ERI calculations use the 2019 version of ANSI/RESNET/ICC 301, including Addendum A-2019, while the 2018 IECC continues to use the 2014 version of the standard. As a result, FBC-EC ERI calculations include updated calculations for clothes washers, dryers and dishwashers. These calculation changes may provide a little more credit for homes complying with the 2020 FBC-EC, making it slightly less stringent than the 2018 IECC in applicable cases, but no stringency difference in anticipated practice.

The 2020 FBC-EC and 2018 IECC also have different maximum Energy Rating Index values for Florida, with the IECC requiring an Index no greater than 57 and the FBC-EC requiring an Index no greater than 58. So the FBC-EC is slightly less stringent here, but each code's Index requirement is low enough that projects that would likely be able to meet it would also be able to comply by the Prescriptive or Performance method. So while the 2020 FBC-EC ERI compliance option is strictly speaking slightly less stringent than the 2018 IECC, this difference does not make the FBC-EC less stringent in anticipated practice.

Other ERI Differences

There are several additional ERI section differences between the 2020 FBC-EC and 2018 IECC regarding software tool capabilities and approval, but the effects of these differences on stringency would be difficult to estimate without long-term field data. The 2020 FBC-EC also requires that verification of ERI compliance be completed "in accordance with Florida Statutes 553.990 (Building Energy Efficiency Rating System)" which includes verifier qualification requirements. These qualification requirements may result in greater Florida ERI accuracy consistency, but it would again be difficult to estimate impact on stringency without long-term field data.

Other Relevant Code Changes

Three additional differences between the 2020 Florida codes and 2018 International codes that are not included in Chapter 4 of the FBC-EC but still affect code stringency are noted below.

Residential Code Section M1602.3 Balanced Return Air

The 2020 Florida Building Code, Residential volume (FRC) includes a thermal distribution system return air provision that is not included in the 2018 International Residential Code (IRC) that directly affects house air pressures and infiltration, and in turn energy use:

M1602.3 Balanced Return Air. Restricted return air occurs in buildings when returns are located in central zones and closed interior doors impede air flow to the return grill or when ceiling spaces are used as return plenums and fire walls restrict air movement from one portion of the return plenum to another. Provisions shall be made in both residential and commercial buildings to avoid unbalanced air flows and pressure differentials caused by restricted return air. Pressure differentials across closed doors where returns are centrally located shall be limited to 0.01 inch WC (2.5 Pa) or less. Pressure differentials across fire walls in ceiling space plenums shall be limited to 0.01 inch WC (2.5 Pa) by providing air duct pathways or air transfer pathways from the high pressure zone to the low zone.

Exceptions:

1. Transfer ducts may achieve this by increasing the return transfer 1½ times the cross sectional area (square inches) of the supply duct entering the room or space it is serving and the door having at least an unrestricted 1 inch undercut to achieve proper return air balance.

2. Transfer grilles shall use 50 square inches (of grille area) to 100 cfm (of supply air) for sizing through-the-wall transfer grilles and using an unrestricted 1 inch undercutting of doors to achieve proper return air balance.

3. Habitable rooms only shall be required to meet these requirements for proper balanced return air excluding bathrooms, closets, storage rooms and laundry rooms, except that all supply air into the master suite shall be included.

Research in 70 central Florida homes before this provision was added to the Florida Residential Code (Cummings and Withers 2006) found the average infiltration rate increased from 0.46 air changes per hour (ach) when the air hander was operating and all interior doors were open to 0.60 ach when all interior doors were closed. By reducing room pressures with respect to the outdoors and unconditioned spaces, this return air provision reduces infiltration, resulting in a lower overall infiltration rate and energy savings. However, since the infiltration increase measured in the research above was for all interior doors closed and, based on homeowner reports from the same study interior doors are estimated to all be closed only 11% of the time on average, the stringency increase is somewhat limited.

Residential Code Section R303.4 Mechanical Ventilation

The 2020 Florida Building Code, Residential volume (FRC) includes a whole-house mechanical ventilation requirement “trigger” of < 3 ACH50 vs. 5 ACH50 in the 2018 IRC. While the average new home ACH50 in Florida is over 5 (Withers et al. 2012), there is significant spread in the ACH50 values (Vieira et al. 2016), so this ventilation trigger difference will mean a number of homes that would have been required to have mechanical ventilation under the 2018 IRC will not be required to have it under the 2020 FRC. As a result, some Florida energy use reduction should be realized.

Code Software Approval

Section R101.5.1 of the 2020 FBC-EC requires that software used for Florida compliance be approved by the Florida Building Commission while the 2018 IECC allows code official approval of software. While the Florida approval requirements may result in greater code compliance consistency, it is difficult to estimate impact on stringency without long-term field data.

Code Changes Summary

Table 1 provides a summary of the differences between the 2020 FBC-EC and 2018 IECC discussed above, together with the anticipated impact of each on code stringency.

Table 1. 2020 FBC-EC vs. 2018 IECC Differences Summary and Stringency Impacts.

Provision Type	Code Section	Difference Summary	Anticipated Effect on FBC-EC Stringency wrt. IECC
CHAPTER 1 SCOPE AND ADMINISTRATION			
Scope and Admin.	R101.5.1	FBC-EC compliance calculation software approval requirement	May increase consistency but difficult to assess stringency without field data
CHAPTER 3 GENERAL REQUIREMENTS			
General Requirements	R303.1.1.1.1	FBC-EC insulation R-value clarification	Slightly more stringent (depending on typical practice)
General Requirements	R303.2.1	FBC-EC insulation installation requirements	Slightly more stringent (depending on typical practice)
CHAPTER 4 RESIDENTIAL ENERGY EFFICIENCY			
Mandatory	R402.4	FBC-EC exception allows R-2 and multiple attached single-family dwellings to comply with commercial code air leakage testing requirements	Difficult to assess without field data
Mandatory	R402.4.1.2	Building air leakage rate max ACH50 = 5 in IECC vs. 7 in FBC-EC	Less stringent
Mandatory	R402.4.1.2	FBC-EC building air leakage tester approval requirement	Possibly slightly more stringent
Mandatory	R402.4.1.2	FBC-EC building air leakage testing exemption for additions	Little or no impact (in applicable cases)

Mandatory	R402.4.2	IECC removed UL 907 listing and labeling requirement for the doors of masonry fireplaces	Possibly slightly less stringent (in applicable cases)
Mandatory	R403.3.2	FBC-EC duct sealing and testing requirements	Either limited impact or difficult to assess without field data
Mandatory	R403.3.3	Exceptions to the FBC-EC Duct Testing section	Either no impact or Performance related (discussed separately)
Mandatory	R403.3.6	New IECC stipulations for ducts buried within ceiling insulation	Little or no stringency impact anticipated (in applicable cases)
Mandatory	R403.3.7	New IECC specifications for ducts considered inside conditioned space	Slightly more stringent (in applicable cases)
Mandatory	R403.5.5	FBC-EC heat trap requirement for storage water heaters	Slightly more stringent (in applicable cases)
Mandatory	R403.7.1	Additional FBC-EC heating and cooling equipment sizing requirements	Slightly more stringent (depending on typical practice)
Mandatory	R403.10.3	Increased percentage of pool and spa heating from heat pump or on-site renewables for IECC cover exemption	Slightly less stringent (in applicable cases)
Mandatory	R403.13	New FBC-EC requirements for dehumidifiers	Slightly more stringent (in applicable cases)
Mandatory	R403.13.1	New FBC-EC requirements for ducted dehumidifiers	Slightly more stringent (in applicable cases)
Mandatory	R404.1	FBC-EC changes make Florida lighting efficacy requirements similar to IECC lighting efficacy requirements	Increases FBC-EC stringency so FBC-EC and IECC now about equal
Prescriptive	R402.1.2	FBC-EC Table R402.1.2 maximum *U*-factor increase for impact rated fenestration	Slightly less stringent (in applicable cases)
Prescriptive	R402.2.2	IECC adds insulation stipulations for ceilings without attic spaces and insufficient space for otherwise required insulation	Slightly less stringent (in applicable cases)
Prescriptive	Table R402.2.6	2018 IECC change removes one of the steel frame wall R-	Slightly less stringent (in applicable cases)

		13 wood frame equivalence options	
Prescriptive	R403.3.6	Air handlers not allowed in attics for FBC-EC Prescriptive compliance	More stringent
Prescriptive	R403.7.2	FBC-EC change prohibits electric resistance from being primary heating used in Climate Zone 2 for Prescriptive compliance	More stringent (in applicable cases)
Performance	R405.2.1	FBC-EC minimum ceiling insulation levels	No impact
Performance	R405.2.3	New FBC-EC subsection clarifies when Performance compliance duct air leakage testing is required and maximum leakage rate	Likely slightly more stringent (in applicable cases)
Performance	R403.3.3	Section R405 duct leakage testing exception and clarification	No impact
Performance	R405.3	Performance-based compliance calculation methodology	See Simulations section of report
Performance	R405.4.2	IECC allows batch compliance sampling for stacked multiple-family units	More stringent (in applicable cases)
Performance	R405.5	FBC-EC Table R405.5.2(1) Reference Design skylight	Slightly less stringent (in applicable cases)
Performance	R405.5	FBC-EC changes Table R405.5.2(1) Reference Design air exchange leakage rate from IECC's rate of ACH50 = 5 to 7	Less stringent
Performance	R405.5	FBC-EC includes new Table R405.5.2(1) Reference and Proposed Design dehumidification systems and dehumidistat specifications	Slightly more stringent (in applicable cases and depending on typical practice)
Performance	R405.5	Table R405.5.2(1) Reference Design equipment efficiencies differences	Little or no impact
Performance	R405.5	FBC-EC changes Table R405.5.2(1) service water heating Reference and	Minimal impact for base code storage type system; will vary

		Proposed Design use and energy consumption specifications to be according to ANSI/RESNET/ICC Standard 301	for other system types and measures
Performance	R405.5	Differences between FBC-EC and IECC Table R405.5.2(1) thermal distribution systems Reference and Proposed Design specifications	Slightly less stringent in applicable cases
Performance	R405.5	IECC Table R405.5.2(1) footnote “a” continues to allow the building air leakage testing requirement to be at the discretion of the code official.	Slightly more stringent in some cases, depending on typical practice
Performance	R405.5	FBC-EC Table R405.5.2(1) footnote “e” adds clarification for how projects without proposed heating systems should be handled	Little or none
Performance	R405.5	FBC-EC Table R405.5.2(1) footnote “h” Reference Design multi-family fenestration area backstop value	Less stringent (in applicable cases)
Performance	R405.5.3.1	FBC-EC glazing areas to include manufacturer’s frame area	Possibly slightly more stringent (depending on typical practice)
Performance	R405.5.3.1	FBC-EC allows area of existing window enclosed by addition to be subtracted from addition’s glazing area for same overhang and orientation	Slightly less stringent (in applicable cases)
Performance	R405.5.3.2	FBC-EC window overhang specifications	Possibly slightly more stringent (depending on typical practice)
Performance	R405.5.3.3	Accounting for door glazing in calculations	Somewhat more stringent (in applicable cases)
Performance	R405.5.3.4	FBC-EC maximum fenestration SHGC overhang depth alternative	Little or no impact (in applicable cases)

Performance	R405.6.3.1	FBC-EC EF adjustment factor for instantaneous water heaters	More stringent (in applicable cases)
Performance	R405.7	Performance compliance credit options	Possibly slightly more stringent (in applicable cases)
ERI	R406.2	Mandatory requirements for buildings that utilize on-site renewable power production	No impact
ERI	R406.3	Energy Rating Index details	Difficult to assess
ERI	R406.4	2020 FBC-EC ERI calculations use the 2019 version of ANSI/RESNET/ICC 301, including Addendum A-2019	Slightly less stringent, but no impact in anticipated practice
ERI	R406.4	Maximum Energy Rating Index in FBC-EC is 58 vs. 57 in IECC	Slightly less stringent, but no impact in anticipated practice
FLORIDA BUILDING CODE, RESIDENTIAL VOLUME			
Residential Code	M1602.3	Balanced return air requirement	Slightly more stringent
Residential Code	R303.4	Mechanical ventilation trigger 5 ACH50 in IECC vs. < 3 ACH50 in FBC-EC	May make Florida homes use less energy due to less fan power in applicable cases

Prescriptive and Performance Compliance Simulations

EnergyGauge USA energy modeling software, which is currently used for 2018 IECC and 2017 FBC-EC compliance calculations, was used to compare the Prescriptive and Performance compliance method stringencies of the 2018 IECC and 2020 FBC-EC.

Prescriptive Compliance Simulations

The Prescriptive compliance comparison included three all-electric dwelling units: a 2,000 sq. ft. single story, single-family house, a 2,400 sq. ft. two story, single-family house, and a 1,200 sq. ft. multi-family unit with either 2018 IECC or 2020 FBC-EC Prescriptive code minimum component and equipment efficiencies, modeled in three Florida cities: Miami, Tampa and Jacksonville. Miami represents IECC Climate Zone 1 and Tampa and Jacksonville are both in Climate Zone 2. House characteristics are shown in Table 2.

Multi-family residential construction in Florida commonly includes two story and three story buildings. As a result, while duct location for typical single-family homes in the state is roughly estimated to be 80% in the attic and 20% in conditioned space (further discussed below), a higher percentage of multi-family units will have ducts in conditioned space verses ducts in the attic. So for multi-family units in this study, energy use results were weighted 40% ducts in the vented attic and 60% ducts in conditioned space via simulating top floor units with ceilings adjacent to attic space and attic supply and return ducts (40% weighting) and "embedded" first floor units with a neighbor unit above (60% weighting).

Table 2. Prescriptive Comparison House Characteristics.

Component	Climate Zone 1		Climate Zone 2	
	2018 IECC	**2020 FBC-EC**	**2018 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 insul. *R*-value	13	13	13	13
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 / 120	300 / 360 / 120	300 / 360 / 120	300 / 360 / 120
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	38	38
Envelope ACH50 (air chng/hr @ 50pa)	5	7	5	7
HP SEER / HSPF	14 / 8.2	14 / 8.2	14 / 8.2	14 / 8.2
AHU location (one story / two story / multi)	Garage / Garage / Cond. Space	Garage / Garage / Cond. Space	Garage / Garage / Cond. Space	Garage / Garage / Cond. Space
Duct insul. *R*-value	8 / 8 / 6 or 8*	8 / 8 / 6 or 8*	8 / 8 / 6 or 8*	8 / 8 / 6 or 8*
Duct location (one story / two story / multi)	Attic / Attic / Cond. Space or Attic*	Attic / Attic / Cond. Space or Attic*	Attic / Attic / Cond. Space or Attic*	Attic / Attic / Cond. Space or 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 (one story / two story / multi)	3 / 4 / 2	3 / 4 / 2	3 / 4 / 2	3 / 4 / 2
Water heater size (gallons)	50 / 50 / 40	50 / 50 / 40	50 / 50 /40	50 / 50 / 40
Water heater UEF (electric)	0.921	0.921	0.921	0.921
Water heater location (one story / two story / multi)	Garage / Garage / Cond. Space	Garage / Garage / Cond. Space	Garage / Garage / Cond. Space	Garage / Garage / Cond. Space

Water heater pipe insulation *R*-value	3	3	3	3
Water heater heat trap	No	Yes	No	Yes

* R-8 duct insulation and attic located supply and return ducts used for FBC-EC and IECC multi-family top floor units.

All houses were modeled with wood frame walls. Since the 2018 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, an annual simulation was run to estimate cooling, heating and water heating energy use. Table 3 shows the simulation results for the 2,000 sq. ft. one story single-family house in each of the three modeled cities. Table 4 shows the results for the 2,400 sq. ft. two story single-family house, and Table 5 shows the results for the 1,200 sq. ft. multi-family unit. Positive differences between the FBC-EC and IECC energy use values mean that the Prescriptive 2020 FBC-EC is less stringent than the Prescriptive 2018 IECC while negative differences mean the FBC-EC is more stringent than the IECC.

Table 3. One Story House Prescriptive Comparison Annual Energy Use Estimates.

City		Heating (kWh/yr)	Cooling (kWh/yr)	Wtr Htg (kWh/yr)	Total (kWh/yr)
Miami	FEC	104	5857	2222	8183
	IECC	93	5693	2249	8035
	Diff.	11	164	-27	148
Tampa	FEC	542	4526	2458	7526
	IECC	482	4416	2488	7386
	Diff.	60	110	-30	140
Jacksonville	FEC	1515	3109	2706	7330
	IECC	1376	3033	2738	7147
	Diff.	139	76	-32	183

Table 4. Two Story House Prescriptive Comparison Annual Energy Use Estimates.

City		Heating (kWh/yr)	Cooling (kWh/yr)	Wtr Htg (kWh/yr)	Total (kWh/yr)
Miami	FEC	132	6845	2561	9538
	IECC	112	6557	2589	9258
	Diff.	20	288	-28	280
Tampa	FEC	736	5219	2834	8789
	IECC	644	5024	2864	8532
	Diff.	92	195	-30	257
Jacksonville	FEC	2151	3567	3121	8839
	IECC	1942	3434	3153	8529
	Diff	209	133	-32	310

Table 5. Multi-family Prescriptive Comparison Annual Energy Use Estimates.

City		Heating (kWh/yr)	Cooling (kWh/yr)	Wtr Htg (kWh/yr)	Total (kWh/yr)
Miami	Wgtd. FBC-EC	19	2800	1896	4715
	Wgtd. IECC	14	2712	1925	4651
	Diff.	5	88	-29	64
Tampa	Wgtd. FBC-EC	128	2135	2081	4343
	Wgtd. IECC	105	2079	2110	4294
	Diff.	23	56	-29	50
Jacksonville	Wgtd. FBC-EC	374	1535	2276	4184
	Wgtd. IECC	312	1494	2305	4111
	Diff	62	40	-29	73

The tables show that for Prescriptive compliance, the 2020 FBC-EC is consistently somewhat less efficient than the 2018 IECC for both the one story and two story sample houses in all three cities, but in all cases the total use difference is less than 4%. It should also be noted that the new FBC-EC prescriptive electric resistance space heating prohibition for Climate Zone 2 is not reflected in these simulations. This prohibition will likely make the prescriptive FBC-EC more stringent than reflected here, and also serves as an example of how including equipment efficiency stipulations in codes as is done in the FBC-EC can help improve overall building efficiency.

Performance Compliance Simulations

Similar to the Prescriptive compliance simulations, the Performance compliance comparison simulations used three all electric dwelling units: a 2,000 sq. ft. single story, single-family house, a 2,400 sq. ft. two story, single-family house, and a 1,200 sq. ft. multi-family unit modeled in three Florida cities: Miami, Tampa and Jacksonville. Miami again represents IECC Climate Zone 1 and Tampa and Jacksonville are both in Climate Zone 2. 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 (further discussed below). House characteristics are shown in Table 6.

Table 6. Performance Comparison House Characteristics.

	Climate Zone 1		Climate Zone 2	
Component	**2018 IECC**	**2020 FBC-EC**	**2018 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 *U*-factor	0.084	0.084	0.084	0.084
Wall solar absorptance	0.75	0.75	0.75	0.75
Window area (ft^2) (one story / two story / multi)	300 / 360 / 67 or 96*	300 / 360 / 67 or 96*	300 / 360 / 67 or 96*	300 / 360 / 67 or 96*
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 *U*-factor	0.035	0.035	0.030	0.030
Envelope ACH50 (air chng/hr @ 50pa)	5	7	5	7
HP SEER / HSPF	14 / 8.2	14 / 8.2	14 / 8.2	14 / 8.2
AHU location	Garage if tested / Cond. if not tested and for multi-family	Conditioned space	Garage if tested / Cond. if not tested and for multi-family	Conditioned space
Duct insul. *R*-value (supply / return)	6 or 8 / 6 or 8**	6 / 6**	6 or 8 / 6 or 8**	6 / 6**
Duct location	Attic if tested / Cond. if not tested	Conditioned space	Attic if tested / Cond. if not tested	Conditioned space
Duct leakage	Qn_{out}= 0.04 /	DSE = 0.88**	Qn_{out}= 0.04 /	DSE = 0.88**

	DSE = 0.88**		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) (one story / two story / multi)	50 / 50 / 40	50 / 50 / 40	50 / 50 / 40	50 / 50 / 40
Water heater UEF (Electric)	0.921	0.921	0.921	0.921
Water heater location (one story / two story / multi)	Garage / Garage / Cond. Space	Garage / Garage / Cond. Space	Garage / Garage / Cond. Space	Garage / Garage / Cond. Space
Water heater heat trap	No	Yes	No	Yes

* Multi-family window areas vary due to differences in reference fenestration area calculations between the FBC-EC and IECC for dwelling units with common (neighbor) walls.

** As further discussed below, since the IECC stipulates both untested and tested duct reference options, two simulations were run for each IECC reference house. One IECC house had non-tested R-6 ducts in conditioned space with a distribution system efficiency (DSE) of 0.88, and the other had R-8 ducts in unconditioned space and leakage of Qn_{out} = 0.04. All FBC-EC reference houses simulated had R-6 ducts in conditioned space with DSE of 0.88.

All houses were again modeled with wood frame walls. Since the 2018 IECC and 2020 FBC-EC both use the same wall reference *U*-factors, there should be no appreciable differences in results for mass walls. As described in Table 1, there are some cases not included in the simulations where other energy use differences might occur such as houses with skylights.

After each house was entered in EnergyGauge USA, annual simulations were run to estimate cooling, heating and water heating energy use for the standard reference 2018 IECC house and standard reference 2020 FBC-EC house. The standard 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[5]. 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.

The 2018 IECC includes reference options for both tested and untested duct systems, so IECC simulations were run for each of these cases. IECC reference duct and air handler locations are however not stipulated. Since the IECC allows tested ducts in unconditioned space, tested duct systems were modeled in an unconditioned, vented attic with air handlers in the garage (except

[5] See Section R405 and Table R405.5.2(1) of the 2018 IECC and 2020 FBC-EC for more information on reference houses.

air handlers were modeled in conditioned space for multi-family). Per IECC requirements for untested duct systems, untested ducts were modeled with the ducts and air handler in conditioned space. Since most duct systems in single-family Florida residences are installed in unconditioned attics[6], energy use results were weighted 80% for tested ducts in the attic and 20% for untested ducts in conditioned space for the one and two story houses.

Multi-family residential construction in Florida commonly includes two story and three story buildings. As a result, a higher percentage of multi-family units will have ducts in conditioned space verses ducts in the attic, so for multi-family units in this study, energy use results were weighted 40% tested ducts in the attic and 60% untested ducts in conditioned space. Multi-family weighting was accomplished by simulating both a first floor “embedded” unit with neighbor unit above and a top floor unit with vented attic. Since the top floor unit would also have a ceiling adjacent to the attic, FBC-EC simulations also included both a first floor and top floor unit, also weighted 40% top floor units and 60% first floor units, but since the FBC-EC only has a conditioned space reference, its top floor unit still had ducts in conditioned space with a DSE of 0.88.

Table 7 shows the estimated space heating, cooling, water heating, and total energy use, and energy use differences for the 2,000 sq. ft. one story single-family house in each of the three modeled cities. Table 8 shows the same results for the 2,400 sq. ft. two story single-family house, and Table 9 shows the results for the 1,200 sq. ft. multi-family unit. Positive differences between the Florida Code (FBC-EC) and weighted IECC energy use values again mean that the FBC-EC is less stringent than the IECC while negative differences mean the FBC-EC is more stringent than the IECC.

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[6] A 2013 code compliance form analysis report by the University of Florida (Nash 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 7. One Story House Performance Comparison Annual Energy Use Estimates.

City		Heating (kWh/yr)	Cooling (kWh/yr)	Wtr Htg (kWh/yr)	Total (kWh/yr)
	FBC-EC	125	5377	2222	7724
Miami	Wgtd. IECC	123	5430	2250	7802
	Diff.	2	-53	-28	-78
	FBC-EC	571	4086	2459	7116
Tampa	Wgtd. IECC	574	4221	2488	7283
	Diff.	-3	-135	-29	-167
	FBC-EC	1546	2879	2707	7132
Jacksonville	Wgtd. IECC	1558	2925	2739	7222
	Diff.	-12	-46	-32	-90

Table 8. Two Story House Performance Comparison Annual Energy Use Estimates.

City		Heating (kWh/yr)	Cooling (kWh/yr)	Wtr Htg (kWh/yr)	Total (kWh/yr)
	FBC-EC	189	6617	2561	9367
Miami	Wgtd. IECC	181	6587	2589	9357
	Diff.	8	30	-28	10
	FBC-EC	774	5175	2835	8784
Tampa	Wgtd. IECC	772	5208	2865	8845
	Diff.	2	-33	-30	-61
	FBC-EC	1927	3799	3121	8847
Jacksonville	Wgtd. IECC	1919	3817	3154	8890
	Diff.	8	-18	-33	-43

Table 9. Multi-family Performance Comparison Annual Energy Use Estimates.

City		Heating (kWh/yr)	Cooling (kWh/yr)	Wtr Htg (kWh/yr)	Total (kWh/yr)
Miami	Wgtd. FBC-EC	26	2619	1896	4540
	Wgtd. IECC	19	2495	1925	4439
	Diff.	7	123	-29	101
Tampa	Wgtd. FBC-EC	152	1992	2081	4225
	Wgtd. IECC	129	1920	2110	4159
	Diff.	23	72	-29	66
Jacksonville	Wgtd. FBC-EC	431	1431	2276	4138
	Wgtd. IECC	376	1376	2305	4057
	Diff.	55	55	-29	81

The performance compliance tables show a range of results. For the one and two story single-family houses the 2020 FBC-EC has slightly less cooling energy use than the weighted 2018 IECC in most cases, and slightly more energy use in most cases for space heating. The FBC-EC has slightly less energy use than the IECC for water heating for all three buildings in all three cities because of the FBC-EC heat trap provision. Combining all three use categories shows the 2020 FBC-EC to have slightly less energy use than the weighted 2018 IECC on a total basis for both one and two story homes in all three cities in this study. However, in large part due to there being fewer attic ducts in multi-family buildings, the simulations show the 2018 IECC to have slightly less energy use on a total basis for multi-family buildings. Still, when one and two story single-family and multi-family results are combined[7], the 2020 FBC-EC results show slightly less overall Performance energy use than the 2018 IECC.

Discussion

A review of the various differences between the 2020 FBC-EC and 2018 IECC discussed above shows a range of stringency impacts, from making the Florida code more stringent to no impact to making the Florida code less stringent. A number of the changes only apply in certain cases such as if a multi-family project, or if certain efficiency credits apply to a project. Two of the most significant changes between the two codes are the FBC-EC's increased maximum building

[7] Single-family and multi-family results were equally weighted; this is supported by NAHB reported Census building permit data for the state: https://www.nahb.org/News-and-Economics/Housing-Economics/State-and-Local-Data/Building-Permits-by-State-and-Metro-Area

air leakage ACH50 and storage water heater heat trap requirement, the first making the Florida code somewhat less stringent and the second making it slightly more stringent.

Prescriptive code minimum one and two story single-family houses and a multi-family unit simulated in three Florida cities showed the Prescriptive 2020 FBC-EC to be consistently slightly less stringent than the Prescriptive 2018 IECC. However, there are some cases that were not modeled where Prescriptive energy use for the FBC-EC would be less. These include homes where air handlers are located in attic spaces and Climate Zone 2 primary electric resistance heating. The IECC allows these two practices for Prescriptive compliance whereas Florida prohibits them. Had we chosen to model a percentage of homes with these factors the FBC-EC would look considerably more favorable as each has a significant impact.

The Performance compliance tables show a range of results, but combined for all three building types simulated in all three Florida cities, the 2020 FBC-EC results show slightly less overall Performance energy use than the 2018 IECC .

Based on their code related work, the authors anticipate that over 90% of new Florida residential construction complies via the Performance method. For example, code forms from all 31 new homes evaluated for a 2012 Florida code compliance study (Withers et al. 2012) were Performance based. A total of 27 additional code forms acquired for a 2018 Florida air leakage testing study were also all Performance compliance (Sonne 2018—12 of the 27 acquired forms were specifically noted in the study report).

As shown in Table 10, based on straight average differences in estimated Prescriptive and Performance energy use from the sample home simulations run, the 2020 FBC-EC starts to exceed the stringency of the 2018 IECC in the state as a whole (equal weighting to Jacksonville, Tampa and Miami results for all three building types simulated) if 90% or more of compliance is via the Performance method.

Table 10. Point of Equal Stringency Calculations.

2020 FBC-EC vs. 2018 IECC Point of Equal Stringency Calculations for one and two story single family and multi-family units combined	
Prescriptive FBC-EC vs. IECC Average Difference (kWh/yr)* =	167
Performance FBC-EC vs. IECC Average Difference (kWh/yr)* =	-20
Stringency Difference between FBC-EC and IECC by Performance Weighting (kWh/yr)*:	
- 85% Performance weighting	8
- 88% Performance weighting	2
- 89% Performance weighting	0
- 90% Performance weighting	-1
- 91% Performance weighting	-3
- 92% Performance weighting	-5

* Positive values mean IECC is more stringent; negative values mean FBC-EC is more stringent.

One additional factor discussed above that is not included in these results and will tend to increase the efficiency of homes built under the Florida code verses under the International code is the Florida Residential Code's balanced return requirement.

Conclusions

As catalogued above, a number of construction type, component and equipment variables enter into an energy code comparison so actual results will depend on the details of the projects eventually built under the new code. However, evaluated as outlined in this report, the 2020 FBC-EC was shown to start to slightly exceed the stringency of the 2018 IECC if 90% or more of compliance is via the Performance method.

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