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RESIDENTIAL CODE REVIEW
FOR THE 2017 FLORIDA BUILDING ENERGY CODE

FSEC-CR-2061-17

DRAFT Final Report

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Executive Summary

This project was initiated because the state of Florida desired to review provisions of its proposed 2017 residential and commercial building energy codes in order to make a determination if they meet or exceed the 2015 IECC and ASHRAE Standard 90.1-2013.

The commercial review was provided in a parallel report to this one which assessed the stringency of the commercial provisions of the 2017 Florida Energy Code relative to ASHRAE Standard 90.1-2013 (Nigusse and Swami 2016). This report concluded that when all building types are considered, the commercial 2017 Florida Energy Code is slightly more stringent than ASHRAE Standard 90.1-2013.

This project's residential code stringency evaluation activities included:

- Reviewing residential portions of the 2017 Energy Florida Supplement and other 2017 code cycle changes to the 2015 IECC
- Listing changes by Mandatory, Prescriptive, Performance and Energy Rating Index categories and provide anticipated stringency impact for each change
- Using EnergyGauge® USA energy modeling software to compare 2015 IECC and 2017 Florida Energy Code Prescriptive and Performance compliance method stringencies.

A review of the identified code changes shows that the 2017 FEC modifications to the 2015 IECC result in 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 multifamily project, or if certain efficiency credits apply to a project. Two of the most significant changes between the two codes are the increased FEC maximum building air leakage ACH50 and the FEC heat trap requirement, the first making the Florida code somewhat less stringent and the second making it slightly more stringent.

Prescriptive and Performance compliance method based simulations were performed for two sample houses 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 2015 IECC Prescriptive compliance to be somewhat more stringent overall than 2017 Florida Energy Code Prescriptive compliance and 2015 IECC Performance compliance to be slightly less stringent overall compared with 2017 Florida Energy Code 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 including the assumption that 92% or more of the new residential projects in Florida comply via the Performance method, for the one and two story sample homes simulated for this report, the 2017 FEC was shown to meet or slightly exceed the stringency of the 2015 IECC in the state as a whole.

Contents

Introduction

This report summarizes the review and evaluation activities carried out to make a determination whether the residential provisions of the draft 6th Edition (2017) Florida Building Code, Energy Conservation (referred to in this report as the Florida Energy Code or FEC) meet or exceed those of the 2015 International Energy Conservation Code (IECC) base code.

A parallel report assessing the stringency of the commercial provisions of the 2017 FEC relative to ASHRAE Standard 90.1-2013 was delivered in September 2016 (Nigusse and Swami 2016). This report concluded that when all building types are considered, the commercial 2017 FEC is slightly more stringent than ASHRAE Standard 90.1-2013.

Residential code stringency evaluation activities included:

- Reviewing residential portions of the 2017 Energy Florida Supplement and other 2017 code cycle changes to the 2015 IECC
- Listing changes by Mandatory, Prescriptive, Performance and Energy Rating Index categories and provide anticipated stringency impact for each change
- Using EnergyGauge® USA energy modeling software to compare 2015 IECC and 2017 FEC Prescriptive and Performance compliance method stringencies.

Residential Mandatory Requirements and Compliance Options

Chapter 3 of both the 2015 IECC and 2017 FEC 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

Section R303 of Chapter 3 of the 2017 FEC adds several requirements to the 2015 IECC insulation requirements.

R303.1.1.1.1 Insulation R-values

The 2017 FEC adds the following section regarding insulation R-value:

> **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: R402.1.4 Total UA Alternative.

Depending on common practice, this clarification may make the 2017 FEC slightly more stringent than the 2015 IECC.

R303.2.1 Insulation Installation

The 2017 FEC adds the following section regarding insulation installation:

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 2017 FEC slightly more stringent than the 2015 IECC.

Mandatory Requirements

Each 2015 IECC and 2017 FEC compliance option includes mandatory requirements. Several modifications to the 2015 IECC mandatory requirements were made in the 2017 FEC.

R402.4.1.2 Testing

Section R402.4.1.2 from the 2017 FEC below shows the original 2015 IECC building testing language with Florida changes as strike-outs and underlines:

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 ~~ASTM E 779 or ASTM E 1827~~ANSI/RESNET/ICC 380-2016 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) will result in the 2017 FEC being somewhat less stringent than the 2015 IECC. This modification is however due to 2016 Florida legislation which required the change in response to home builders concerns regarding tight houses without reliable mechanical ventilation systems.

An additional change that provides an exception to the Section R402.4.1.2 testing requirement was received during a final comment period that closed February 24, 2017:

> 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.

The Florida Building Commission voted to approve this change on April 4, 2017. The change should help clarify testing requirements and slightly reduce the amount of testing required in the state, but little or no stringency impact is anticipated.

R403.3.2 Sealing

Section R403.3.2 from the 2017 FEC below shows the original 2015 IECC duct sealing language again with Florida changes as strike-outs and underlines:

> **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 C403.2.7.2 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.~~
>
> ~~**Exceptions:**~~
>
> ~~1. Air-impermeable spray foam products shall be permitted to be applied without additional joint seals.~~
>
> ~~2 For ducts having a static pressure classification of less than 2 inches of water column (500 Pa), additional closure systems shall not be required for continuously welded joints and seams, and locking-type joints and seams of other than the snap-lock and button-lock types.~~
>
> Duct tightness shall be verified by testing ~~to Section 803 of the RESNET Standards~~ in accordance with ANSI/RESNET/ICC 380-2016~~5~~ by either ~~an energy rater certified in accordance with~~ individuals as defined in Section 553.99~~03~~(5) or (7), *Florida Statutes*, or individuals licensed as set forth in Section 489.105(3)(f), (g), or (i), *Florida Statutes*, ~~Section 553.99, *Florida Statutes*, or as authorized by *Florida Statutes*,~~ to be "substantially leak free" in accordance with Section R403.3.3.

While the 2017 FEC 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 Leakage Testing

Exceptions to Section R403.3.3 from the 2017 FEC below show the original 2015 IECC exception and additional Florida duct leakage testing exception underlined:

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. Duct testing is not mandatory for buildings complying by Section 405 of this code.

Since this additional Florida duct testing exception only applies to Section R405 of the code, it does not affect Prescriptive compliance efficiency. Performance compliance implications are discussed in the Performance Compliance section below.

R403.5.5 Heat Traps

A Florida addition to Section R403.5 of the 2015 IECC requires heat traps for service hot water systems:

> **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 2015 IECC.

R403.7.1 Equipment sizing

Florida additions to Section R403.7.1 of the 2015 IECC provide additional cooling and heating system sizing requirements and exceptions. Depending on typical practice, it is anticipated that these additions will slightly increase the stringency of the 2017 FEC relative to the 2015 IECC.

Other Mandatory Changes

The 2017 FEC includes several additional Mandatory changes to the 2015 IECC which either do not directly affect stringency or the impact of which would be difficult to determine such as the new Section R402.4 FEC 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 2015 IECC and 2017 FEC provides residential building thermal envelope requirements for prescriptive compliance centered around component efficiencies listed in Tables R402.1.2 and R402.1.4.

Code Table R402.1.2

Section R402 Table R402.1.2 "Insulation and Fenestration Requirements by Component" of the 2015 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	0.35	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.55	0.40	49	20 or 13+5[h]	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.32	0.55	NR	49	20+5 or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

For SI: 1 foot = 304.8 mm.

a. R-values are minimums. *U*-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall not be 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: Skylights may be excluded from glazed fenestration SHGC requirements in climate zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.

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

d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Climate Zones 1 through 3 for heated slabs.

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. Or insulation sufficient to fill the framing cavity, R-19 minimum.

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

i. The second *R*-value applies when more than half 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 2017 FEC also includes this entire table, with no 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 2015 IECC's 0.4 value which does not differentiate for impact fenestration, the note "j" change decreases Florida Prescriptive compliance stringency slightly in applicable cases relative to the 2015 IECC.

Code Table R402.1.4

Table R402.1.4 "Equivalent U-Factors" of the 2015 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	0.35	0.55	0.030	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.35	0.55	0.026	0.060	0.098	0.047	0.059	0.065
5 and Marine 4	0.32	0.55	0.026	0.060	0.082	0.033	0.050	0.055
6	0.32	0.55	0.026	0.045	0.060	0.033	0.050	0.055
7 and 8	0.32	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. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 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. Basement wall *U*-factor of 0.360 in warm-humid locations as defined by Figure R301.1 and Table R301.1.

Only Climate Zones 1 and 2 of Table R402.1.4 apply to Florida, but the 2017 FEC again includes the entire table, and without any changes from the 2015 IECC.

R403.3.6 Air Handler Location

The 2017 FEC adds 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 change will make 2017 FEC Prescriptive compliance more stringent than 2015 IECC Prescriptive compliance.

Other Prescriptive Changes

No additional Chapter 4 Prescriptive modifications are made in the 2017 FEC that directly impact residential stringency.

Performance Compliance

Section R405 of the 2015 IECC and 2017 FEC provides a Simulated Performance Alternative, or "Performance" compliance option that compares heating, cooling and water heating energy costs (IECC) or annual loads (FEC) for a proposed project building with those of a reference building of the same size. The 2017 FEC includes a number of Performance compliance changes from the 2015 IECC.

R405.2.1 Ceiling insulation

A Florida addition to Section R405.2 of the 2015 IECC 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 addition 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 will not increase the stringency of the FEC relative to the 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 FEC 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 as discussed below 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 2017 FEC less stringent than the 2015 IECC.

R405.3 Performance-based Compliance

Florida changes to Section R405.3 of the 2015 IECC modify how performance compliance is calculated and add a reference to an Appendix RC that provides calculation details:

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~~ total normalized Modified Loads that ~~is~~ are less than or equal to the annual ~~energy cost~~ total loads of the *standard reference design* as calculated in accordance with Appendix ~~B~~ 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 Price and Expenditure 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 2017 FEC calculates performance compliance compared with the 2015 IECC, this difference also exists in the current 2014 FEC and has historically still provided similar stringencies. An analysis of 2017 FEC vs. 2015 IECC Performance compliance stringency is provided below in the Prescriptive and Performance Compliance Simulations section of this report.

Code Table R405.5.2(1) Equipment Efficiency Changes

Consistent with previous editions, Table R405.5.2(1) of the 2015 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 2017 FEC, also consistent with previous editions of this code, instead stipulates Standard Reference Design heating, cooling and space heating efficiencies to be "in accordance with prevailing Federal minimum standards." This change in effect means that while both the IECC and FEC Performance compliance methods allow a number of component efficiency "trade-offs," the IECC does not include equipment efficiency trade-off options while the FEC 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 2017 FEC less stringent than the 2015 IECC.

Code Table R405.5.2(1) Non-Tested Thermal Distribution Systems Changes

As discussed above, the 2017 FEC Performance compliance method includes an exception that allows non-tested ducts in unconditioned space. In the 2014 FEC, in such cases the Proposed Design was assigned a distribution system efficiency (DSE) of 0.88. In the 2017 FEC, instead of the DSE of 0.88, a Proposed Design is assigned a Qn_{out} of 0.080. From 2017 FEC Table R405.5.2(1):

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Thermal distribution systems	Distribution System Efficiency: 0.88	Thermal distribution system efficiency shall be as tested in accordance with ~~Section 803 of RESNET Standards~~ ANSI/RESNET/ICC 380-2016~~5~~ or if 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.
	Duct location: entirely within the building thermal envelope	As proposed …….
	Air Handler location: entirely within the building thermal envelope	As proposed… …….
	Duct insulation: R-6	As proposed

This change allows computer programs that calculate Performance compliance to model non-tested default leakage in the same manner they model tested leakage. On average this change does not affect the stringency of the 2017 FEC compared with the 2014 Edition, so it also will not, on average, change stringency compared with the 2015 IECC.

Code Table R405.5.2(1) Skylight Reference

In cases where the Proposed Design will include one or more skylights, the 2017 FEC Performance compliance method includes a skylight for the Standard Reference Design in Table R405.5.2(1):

Skylights	~~None~~ Skylight area= (a) The proposed skylight area, where the proposed fenestration area is less than 15 percent of the conditioned floor area, or; (b) The adjusted skylight area, where the proposed fenestration area is 15 percent or greater of the conditioned floor area. The adjusted skylight area shall be calculated as follows: $ASKY_{adj} = ASKY \times 0.15 \times CFA/AF$ Where $ASKY_{adj}$ = Adjusted skylight area ASKY = Proposed skylight area CFA = Conditioned Floor Area AF= Proposed total fenestration area	As proposed
	Orientation: as proposed	As proposed
	U-factor: as specified in Table R402.1.4	As proposed
	SHGC: as specified in Table R402.1.2 including footnote (b) of that table, except that for climates with no requirement (NR) SHGC=0.40 shall be used.	As proposed
	Interior shade fraction for the area of proposed skylights with SHGC ratings that include a pre-installed interior shade: 0.92-(0.21xSHGC for the standard reference design)	As proposed, with shades assumed closed 50% of the time
	External shading: none	As proposed

Adding Reference skylight area increases the Florida Reference cooling load in applicable cases, decreasing the stringency of the 2017 FEC relative to the 2015 IECC.

Code Table R405.5.2(1) Reference Air Leakage Rate

The 2017 FEC changes the Standard Reference Design air leakage rate to ACH50 = 7 from ACH50 = 5 in the 2015 IECC. From 2017 FEC Table R405.5.2(1):

Air exchange rate	Air leakage rate of ~~5~~ 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 inches w.g. (50 Pa). The mechanical ventilation rate shall be in addition to the air leakage rate and the same as in the proposed design, but no greater than $0.01 \times CFA + 7.5 \times (N_{br+1})$ where: *CFA* = conditioned floor area *Nbr* = number of bedrooms Energy recovery shall not be assumed for mechanical ventilation.	~~For residences that are not tested, the same air leakage rate as the standard reference design. For tested residences, t~~ 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 air leakage rate change increases the Florida Reference cooling and heating loads, so will decrease the stringency of the 2017 FEC relative to the 2015 IECC. The impact of this change is included in the 2017 FEC verses 2015 IECC performance compliance analysis provided below in the Prescriptive and Performance Compliance Simulations section of this report.

Code Table R405.5.2(1) Reference Glazing Area

The 2017 FEC changes the Standard Reference Design's glazing area backstop value from 0.56 in the third printing version of the 2015 IECC to 0.80. In applicable multifamily cases, this change will increase the Reference Design's glazing area and decrease the stringency of the 2017 FEC relative to the 2015 IECC.

R405.5.3.1 Glass Areas

The 2017 FEC adds 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 2017 FEC slightly relative to the 2015 IECC. In the case of applicable additions, the exception included with this change will slightly decrease the stringency of the FEC.

R405.5.3.3 Doors with Glazing

The 2017 FEC adds Section R405.5.3.3 regarding opaque doors with glass:

> **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 is 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 area in doors is 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.

Since similar glazing stipulations are not included in the IECC, in applicable cases this change will slightly increase the stringency of the 2017 FEC relative to the 2015 IECC.

R405.5.3.4 Maximum Fenestration SHGC and Overhang Depth Alternative

The 2017 FEC adds 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.

The 2015 IECC also includes a Climate Zones 1 through 3 maximum fenestration SHGC of 0.50 in Section R402.5. The 2017 FEC moves this requirement to the Performance compliance section of the code and provides a 4-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 2017 FEC adds 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 2017 FEC relative to the 2015 IECC.

R405.7 Performance Compliance Credit Options

Section R405.7 of the 2017 FEC adds five Performance compliance credit options: attic radiant barriers and interior radiation control coatings, cross ventilation, whole house fans, ceiling fans and heat recovery units (roof solar reflectance is included as a sixth credit option, but this characteristic is already incorporated into calculations via Table R405.5.2(1) stipulations in both codes). The FEC allows Performance calculation credit to be taken if the prescriptive criteria for one or more of these credit options are met. The 2015 IECC does not expressly provide for the equipment credits, but since IECC equipment efficiency improvements affect both the Standard Reference Design and Proposed Design equally, these improvements will affect end use weighting. Otherwise, since again both codes' Performance compliance methods maintain a set overall efficiency requirement, these credits do not make the 2017 FEC less stringent than the 2015 IECC.

Energy Rating Index Compliance

Section R406 of the 2015 IECC and 2017 FEC 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 2017 FEC includes several ERI compliance changes from the 2015 IECC.

R406.2 Mandatory Requirements

FEC changes to Section R406.2 of the 2015 IECC differentiate minimum efficiency requirements for ERI projects that utilize on-site renewable power production vs. minimum requirements for ERI projects that do not utilize on-site renewable power:

> **R406.2 Mandatory requirements.** Compliance with this section requires that the provisions identified in Sections R401 through R404 labeled as "mandatory" and Section R403.5.3 of the 2015 *International Energy Conservation Code* be met. For buildings that do not utilize on-site renewable power production for compliance with this section, ~~T~~the building thermal envelope shall be greater than or equal to levels of efficiency and Solar Heat Gain Coefficient in Table 402.1.1 or 402.1.3 of the 2009 *International Energy Conservation Code*. For buildings that utilize on-site renewable power production for compliance with this section, the building thermal envelope shall be greater than or equal to levels of efficiency and Solar Heat Gain Coefficient in Table R402.1.2 or Table R402.1.4 of the 2015 *International Energy Conservation Code*.

This 2017 FEC changes stipulate that if on-site renewable power is used, minimum efficiencies are from the 2015 versions of IECC Table R402.1.2 and Table R402.1.4, verses from the 2009

versions of these IECC tables if on-site renewable power is not used. Since as discussed above, except for one U-factor change for impact glass, there are no changes in the 2017 FEC versions of the 2015 IECC Table R402.1.2 and Table R402.1.4, utilization of on-site renewable power production basically requires a project first comply with the Prescriptive code. As a result, allowing on-site renewable power for Florida ERI compliance will not reduce the stringency of the 2017 FEC.

Code Table R406.4 Maximum Energy Rating Index

The 2017 FEC increases the Climate Zone 1 and 2 (all of Florida) Energy Rating Index maximum from 52 in the 2015 IECC to 58. While this change makes the 2017 Florida ERI compliance method less stringent than the 2015 IECC ERI method, the Florida ERI maximum is still low enough that projects that would be able to meet or exceed it would also be able to comply by the Performance method. So FEC stringency will not actually be reduced compared to the 2015 IECC in anticipated practice.

Other ERI Changes

There are several other 2017 FEC changes to the ERI section of the 2015 IECC which provide clarification, but do not affect stringency. Another FEC ERI change 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 be difficult to estimate impact on stringency without long-term field data.

Other Relevant Code Changes

Three additional 2017 Florida changes that are not included in Chapter 4 of the FEC but still affect code stringency are noted below.

Residential Code Section M1602.3 Balanced Return Air

The 2017 Florida Building Code, Residential volume (FRC) adds a thermal distribution system return air provision to the 2015 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 pascals) or less. Pressure differentials across fire walls in ceiling space plenums shall be limited to 0.01 inch WC (2.5 pascals) 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 ar 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. [Code mod M6748]

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 2017 Florida Building Code, Residential volume also changes the whole-house mechanical ventilation requirement "trigger" from 5 ACH50 in the 2015 IRC to < 3 ACH50. 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 FRC change will mean a number of homes that would have been required to have mechanical ventilation under the 2015 IRC will not be required to have it under the 2017 FRC. As a result, some Florida energy use reduction should be realized.

Code Software Approval

A 2017 Florida change to Section R101.5.1 of the 2015 IECC requires that software used for FEC compliance be approved by the Florida Building Commission while the 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 2017 FEC changes to the 2015 IECC discussed above together with the anticipated impact of each on code stringency.

Table 1. 2017 Florida Energy Code Changes Summary and Stringency Impacts.

Provision Type	Code Section	Change Summary	Anticipated Effect on FEC Stringency wrt. IECC
Scope and Admin.	R101.5.1	Compliance calculation software approval requirement	May increase consistency but difficult to assess stringency without field data
General Requirements	R303.1.1.1.1	Insulation R-value clarification	Slightly more stringent (depending on typical practice)
General Requirements	R303.2.1	Insulation installation requirements	Slightly more stringent (depending on typical practice)
Mandatory	R402.4.1.2	Building air leakage rate max from ACH50 = 5 to 7	Less stringent
Mandatory	R402.4.1.2	Building air leakage testing exemption for additions	Little or no impact (applicable cases only)
Mandatory	R403.3.2	Duct sealing and testing	Difficult to assess without field data
Mandatory	R403.5.5	Heat trap requirement for storage water heaters	Slightly more stringent
Mandatory	R403.7.1	Additional heating and cooling equipment sizing requirements	Slightly more stringent (depending on typical practice)
Prescriptive	R402.1.2	Table R402.1.2 maximum U-factor increase for impact rated fenestration	Slightly less stringent (applicable cases only)
Prescriptive	R403.3.6	Air handlers not allowed in attics for R402 compliance	More stringent (applicable cases only)
Performance	R405.2.1	Minimum ceiling insulation levels	Little or no impact
Performance	R403.3.3	Section R405 duct leakage testing exception	Little or no impact
Performance	R405.3	Performance-based compliance calculation methodology	See Simulations section
Performance	R405.5	Table R405.5.2(1) Reference Design equipment efficiencies	Little or no impact
Performance	R405.5	Table R405.5.2(1) Proposed Design non-tested thermal distribution system leakage rate (Qn)	Little or no impact
Performance	R405.5	Table R405.5.2(1) Reference Design skylight	Slightly less stringent (applicable cases only)

Performance	R405.5	Table R405.5.2(1) Reference Design air leakage rate from ACH50 = 5 to 7	Less stringent
Performance	R405.5	Table R405.5.2(1) Reference Design multifamily glazing area backstop value	Slightly less stringent (applicable cases only)
Performance	R405.5.3.1	Glazing areas to include manufacturer's frame area	Possibly slightly more stringent (depending on typical practice)
Performance	R405.5.3.1	Area of existing window enclosed by addition subtracted from addition's total glazing area	Slightly less stringent (applicable cases only)
Performance	R405.5.3.3	Accounting for door glazing in calculations	Slightly more stringent (applicable cases only)
Performance	R405.5.3.4	Maximum fenestration SHGC overhang depth alternative	Little or no impact (applicable cases only)
Performance	R405.6.3.1	EF adjustment factor for instantaneous water heaters	More stringent (applicable cases only)
Performance	R405.7	Performance compliance credit options	Little or no impact (applicable cases only)
ERI	R406.2	Mandatory requirements for buildings that utilize on-site renewable power production	No impact
ERI	R406.4	Maximum Energy Rating Index changed from 52 to 58	No impact
Residential Code	M1602.3	Balanced return air requirement	Slightly more stringent
Residential Code	R303.4	Mechanical ventilation trigger from 5 ACH50 to <3 ACH50	May make Florida code 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 2015 IECC and 2014 FEC compliance calculations, was used to compare the Prescriptive and Performance compliance method stringencies of the 2015 IECC and 2017 FEC.

Prescriptive Compliance Simulations

The Prescriptive compliance comparison used all electric 2,000 sq. ft. single story and 2,400 sq. ft. two story, single family houses with either 2015 IECC or 2017 FEC 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.

Table 2. Prescriptive Comparison House Characteristics.

Component	Climate Zone 1		Climate Zone 2	
	2015 IECC	2017 FEC	2015 IECC	2017 FEC
Conditioned floor area (ft^2) (one story / two story)	2,000 / 2,400	2,000 / 2,400	2,000 / 2,400	2,000 / 2,400
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) (one story / two story)	300 / 360	300 / 360	300 / 360	300 / 360
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	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 (^oF)	72 / 75	72 / 75	72 / 75	72 / 75
# of bedrooms (one story / two story)	3 / 4	3 / 4	3 / 4	3 / 4
Water heater size (gallons)	50	50	50	50
Water heater EF (Electric)	0.945	0.945	0.945	0.945
Water heater location	Garage	Garage	Garage	Garage
Water heater heat trap	No	Yes	No	Yes

All houses were modeled with wood frame walls. Since the 2015 IECC and 2017 FEC 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 3 shows the simulation results for the 2,000 sq. ft. one story house in each of the three modeled cities.

Table 4 shows the results for the 2,400 sq. ft. two story house. Positive differences between the FEC and IECC energy use values mean that the Prescriptive 2017 FEC is less stringent than the Prescriptive 2015 IECC while negative differences mean the FEC 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	127	6044	2090	8261
	IECC	113	5801	2117	8031
	Diff.	14	243	-27	230
Tampa	FEC	632	4560	2315	7507
	IECC	568	4374	2345	7287
	Diff.	64	186	-30	220
Jacksonville	FEC	1724	3177	2550	7451
	IECC	1577	3060	2582	7219
	Diff.	147	117	-32	232

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	170	7134	2429	9733
	IECC	152	6851	2457	9460
	Diff.	18	283	-28	273
Tampa	FEC	769	5636	2691	9096
	IECC	695	5417	2721	8833
	Diff.	74	219	-30	263
Jacksonville	FEC	1952	4058	2965	8975
	IECC	1785	3912	2997	8694
	Diff	167	146	-32	281

The tables show that for Prescriptive compliance, the 2017 FEC is consistently somewhat less efficient than the 2015 IECC for both the one story and two story sample houses in all three cities, but in all cases the difference is less than 4%.

Performance Compliance Simulations

Similar to the Prescriptive compliance simulations, the Performance compliance comparison simulations used all electric 2,000 sq. ft. single story and 2,400 sq. ft. two story, single family houses 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. 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). House characteristics are shown in Table 5.

Table 5. Performance Comparison House Characteristics.

Component	Climate Zone 1		Climate Zone 2	
	2015 IECC	2017 FEC	2015 IECC	2017 FEC
Conditioned floor area (ft^2) (one story / two story)	2,000 / 2,400	2,000 / 2,400	2,000 / 2,400	2,000 / 2,400
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*	9.56	9.56	9.56	9.56
Wall solar absorptance	0.75	0.75	0.75	0.75
Window area (ft^2) (one story / two story)	300 / 360	300 / 360	300 / 360	300 / 360
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 insul. R-value*	24	24	28.7	28.7
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	Garage if tested / cond. if not tested	Garage if tested / cond. if not tested	Garage if tested / cond. if not tested
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**	DSE = 0.88	Qn_{out}= 0.04 / DSE = 0.88**	DSE = 0.88
Heating / Cooling set points (^oF)	72 / 75	72 / 75	72 / 75	72 / 75
# of bedrooms (one story / two story)	3 / 4	3 / 4	3 / 4	3 / 4
Water heater size (gallons)	50	50	50	50

Water heater EF (Electric)	0.945	0.945	0.945	0.945
Water heater location	Garage	Garage	Garage	Garage
Water heater heat trap	No	Yes	No	Yes

* Framing fraction = 0.0

** Four houses were run for each IECC column in table representing the reference home. One IECC house had 2,000 square feet of conditioned space and non-tested R-6 ducts in conditioned space, while another had 2,000 square feet and R-8 ducts in unconditioned space and leakage of Qn = 0.04. The other two IECC houses were 2,400 square feet with the same duct variations. All FEC reference houses simulated had R-6 ducts in conditioned space.

All houses were again modeled with wood frame walls. Since the 2015 IECC and 2017 FEC 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 and multifamily houses with small window areas.

After each house was entered in EnergyGauge USA, annual simulations were run to estimate cooling, heating and water heating energy use for the reference 2015 IECC house and reference 2017 FEC 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[1]. Since the total annual energy costs (IECC) or annual loads (FEC) 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 2015 IECC includes a reference stipulation for both tested and untested duct systems, so IECC runs were made for each option. 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 attic with air handlers in the garage. 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 Florida are installed in unconditioned attics[2], energy use results were weighted 80% for tested ducts in the attic and 20% for untested ducts in conditioned space.

[1] See Section R405 and Table R405.5.2(1) of the 2015 IECC and 2017 FEC for more information on reference houses.

[2] 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 6 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. Table 7 shows the same results for the 2,400 sq. ft. two story house. Positive differences between the Florida Code (FEC) and weighted IECC energy use values again mean that the 2017 FEC is less stringent than the 2015 IECC while negative differences mean the FEC is more stringent than the IECC.

Table 6. One Story House Performance Comparison Annual Energy Use Estimates.

City		Heating (kWh/yr)	Cooling (kWh/yr)	Wtr Htg (kWh/yr)	Total (kWh/yr)
Miami	FEC	136	5708	2090	7934
	Wgtd. IECC	134	5702	2118	7954
	Diff.	2	6	-28	-20
Tampa	FEC	630	4293	2315	7238
	Wgtd. IECC	617	4311	2345	7273
	Diff.	13	-18	-30	-35
Jacksonville	FEC	1678	3048	2550	7276
	Wgtd. IECC	1663	3053	2583	7299
	Diff.	15	-5	-33	-23

Table 7. Two Story House Performance Comparison Annual Energy Use Estimates.

City		Heating (kWh/yr)	Cooling (kWh/yr)	Wtr Htg (kWh/yr)	Total (kWh/yr)
Miami	FEC	186	6753	2429	9368
	Wgtd. IECC	182	6740	2457	9379
	Diff.	4	13	-28	-11
Tampa	FEC	770	5328	2691	8789
	Wgtd. IECC	757	5346	2721	8825
	Diff.	13	-18	-30	-36
Jacksonville	FEC	1915	3920	2965	8800
	Wgtd. IECC	1895	3924	2998	8817
	Diff	20	-4	-33	-17

The tables show that the weighted 2015 IECC is slightly more stringent than the 2017 FEC in space heating in all three cities, but except for in Miami, the FEC is slightly more stringent than the weighted IECC in cooling, and the FEC is also slightly more stringent than the IECC in water heating in all three cities. Combining all three use categories, the total differences show the

2017 FEC to be slightly more stringent than the weighted 2015 IECC for both homes in all three cities, but in all cases the difference is less than 1%.

Discussion

A review of the various changes discussed above shows that the 2017 FEC modifications to the 2015 IECC result in 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 multifamily project, or if certain efficiency credits apply to a project. Two of the most significant changes between the two codes are the increased FEC maximum building air leakage ACH50 and the FEC 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 sample houses simulated in three Florida cities showed the Prescriptive 2017 FEC to be consistently somewhat less stringent than the Prescriptive 2015 IECC. There are some cases that were not modeled where energy use for the FEC would be less. These are homes where air handlers are located in attic spaces. The IECC allows that location whereas Florida disallows it for Prescriptive compliance.

Performance code based simulations found that while space heating energy use was consistently slightly higher for the two 2017 FEC compliant sample houses compared to the weighted 2015 IECC compliant houses, space cooling use was slightly lower in four out of six cases, and in all cases the water heating and combined total use was slightly lower for the 2017 FEC houses.

The authors were not able to obtain actual code compliance method use percentages for the state, but based on their code related work 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 FSEC code compliance study (Withers et al. 2012) were Performance based. Based on straight average differences in estimated Prescriptive and Performance energy use from the sample home runs above, the 2017 FEC starts to exceed the stringency of the 2015 IECC in the state as a whole (equal weighting to Jacksonville, Tampa and Miami results) if 92% or more new residential projects comply via the Performance method. One 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 FRC'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 above including the assumption that 92% or more of the new residential projects in Florida comply via the Performance method, for the one and two story sample homes simulated for this report, the 2017 FEC was shown to meet or slightly exceed the stringency of the 2015 IECC in the state as a whole.

A parallel report to this one assessed the stringency of the commercial provisions of the 2017 Florida Energy Code relative to ASHRAE Standard 90.1-2013 (Nigusse and Swami 2016). This report concluded that when all building types are considered, the commercial 2017 Florida Energy Code is slightly more stringent than ASHRAE Standard 90.1-2013.

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