FSEC Energy Research Center

UNIVERSITY OF CENTRAL FLORIDA

Comparison of the 2023 Commercial Florida Building Code, Energy Conservation, 8th Edition with 2021 IECC & ASHRAE 90.1-2019

Draft Final Report
January 31, 2024

Submitted to
Department of Business and Professional Regulation
Office of Codes and Standards
2601 Blair Stone Road
Tallahassee, FL 32399
Contract No. B7DE38

Author
Bereket Nigusse and Muthusamy Swami
bnigusse@fsec.ucf.edu
swami@fsec.ucf.edu

1679 Clearlake Road
Cocoa, FL 32922-5703
Tel: 321-638-1000 • info@fsec.ucf.edu

energyresearch.ucf.edu

Disclaimer

The Florida Solar Energy Center/University of Central Florida nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the Florida Solar Energy Center/University of Central Florida or any agency thereof. The views and opinions of the authors expressed herein do not necessarily state or reflect those of the Florida Solar Energy Center/University of Central Florida or any agency thereof.

Executive Summary

The State of Florida desires to review the 8th Edition (2023) Florida Building Code, Energy Conservation (FBCEC) provisions for commercial buildings and determine if they meet or exceed the 2021 IECC and the 2019 ASHRAE 90.1. For this purpose, the IECC-based and ASHRAE 90.1-based 2023 FBCEC code modifications were reviewed, and those changes with energy impact were identified and quantitatively analyzed using the building energy simulations program.

The IECC-based 2023 FBCEC change review identified 25 energy-impactful code modifications, and 14 were quantitatively analyzed. A brief description of each code change with energy impact included in the 8th Edition (2023) based FBCEC is summarized in Appendix A. Similarly, the ASHRAE 90.1 based 2023 FBCEC change review identified 35 code modifications with energy impact, and 20 were quantitatively analyzed. A brief description of each code change with energy impact included in the 8th Edition (2023) FBCEC ASHRAE 90.1 compliance option is summarized in Appendix B. EnergyPlus, a whole-building energy simulation program, was used for the quantitative analysis of those energy-impactful changes.

The IECC-based 2023 FBCEC and the 2021 IECC energy performance were determined using sixteen commercial prototype building model energy codes. The analysis compared the annual site energy and energy cost performance of the 2023 FBCEC prototype building energy models against that of the 2021 IECC energy models. The 2021 IECC prototype buildings' energy models were used as a reference for the quantitative comparison. The sixteen prototype building energy models of the 2023 FBCEC and the 2021 IECC prototype buildings were updated and simulated for Miami and Orlando, Florida, site locations representing Florida's climate zones 1A and 2A, respectively. The building energy simulation results were processed to determine the annual site Energy Utilization Intensity (EUI) and Energy Cost Index (ECI) values for each of the prototype building's energy models weighted by climate zones 1A and 2A commercial buildings stock floor area distribution of the State.

The site EUIs of the sixteen prototype building types of the IECC-based 2023 FBCEC and the 2021 IECC are shown in Figure I. The annual site EUI aggregated across the sixteen prototype buildings was 44.23 kBtu/ft^2-yr and 43.60 kBtu/ft^2-yr for the IECC-based 2023 FBCEC and the 2021-IECC. The quantitative analysis determined that, on average, the 2023 FBCEC is less stringent in energy efficiency than the 2021 IECC by about 1.43 percent. All the sixteen prototype building energy models of the 2023 FBCEC consumed slightly more energy than the 2021 IECC. The state's code EUI lag is primarily due to the five code modifications in the 2021 IECC but excluded from the 2023 FBCEC. The code changes excluded from the IECC-based 2023 FBCEC were automatic receptacle control, secondary sidelight area control functions, increased stringency for fenestration SHGC and U-Factor, increased stringency for opaque swinging door U-Factors, and addition of Energy Recovery Ventilator (ERV) requirement in multi-family buildings.

The annual site EUIs of the ASHRAE 90.1-based 2023 FBCEC and ASHRAE 90.1-2019 code by prototype building types were determined and are shown in Figure II. The annual site EUI aggregated across the sixteen prototype buildings was 44.15 kBtu/ft^2-yr and 43.95 kBtu/ft^2-yr for the ASHRAE 90.1-based 2023 FBCEC and the 2019 ASHRAE 90.1 code, respectively. The

ASHRAE 90.1-based 2023 FBCEC weighted average energy use was higher by about 0.45 percent due to the exclusion of Section 8.4.2 Automatic receptacle control and Section 9.4.1.1(g) Automatic partial-off interior lighting control.

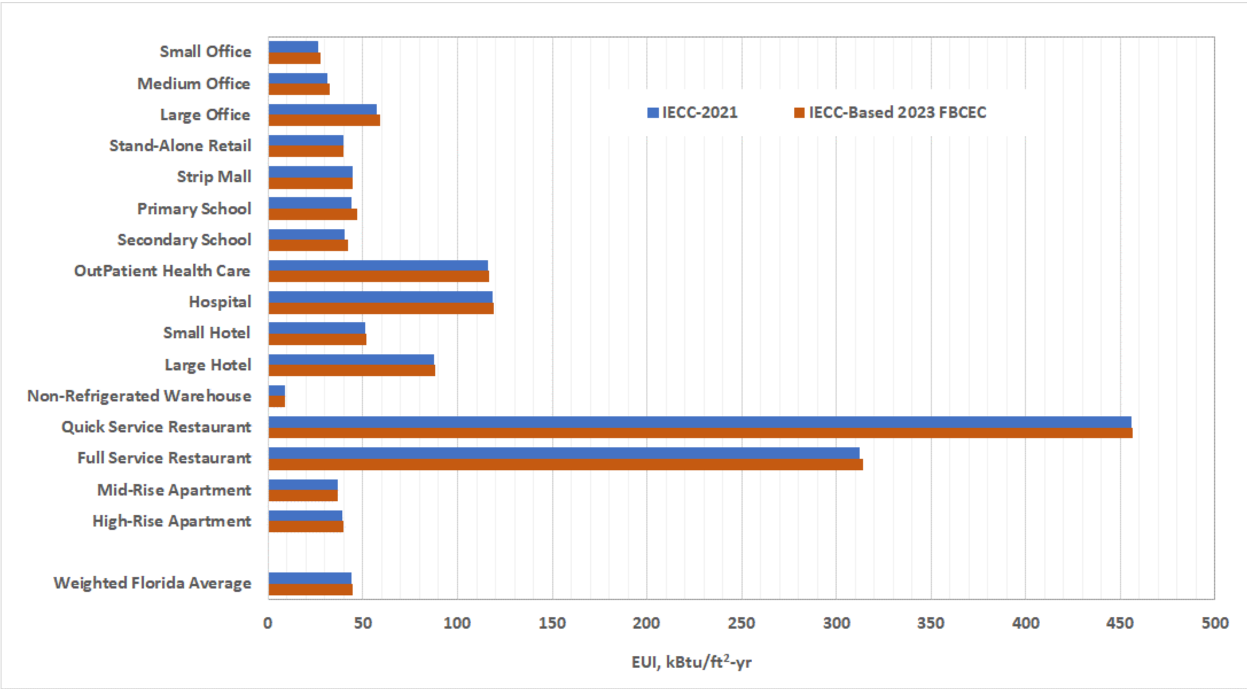

Figure I Site EUI of the IECC-Based 2023 FBCEC and 2021 IECC by Prototype Building

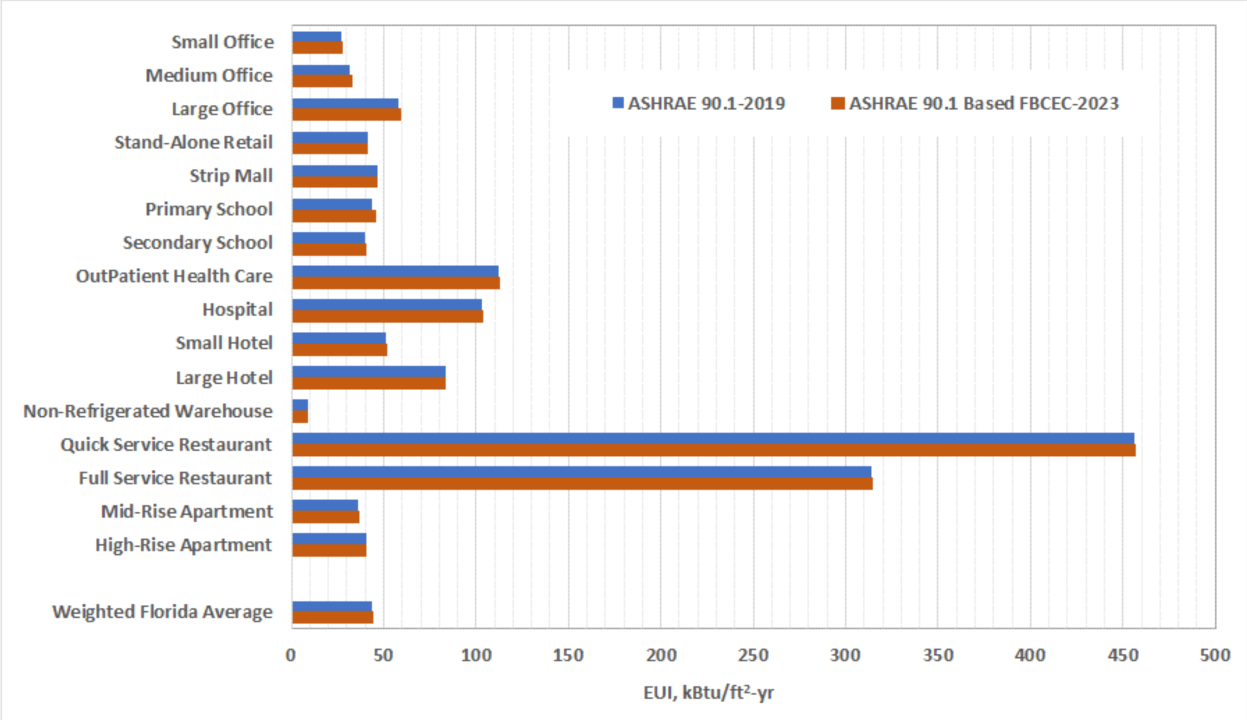

Figure II Site EUI of the ASHRAE 90.1-Based 2023 FBCEC and 2019 ASHRAE 90.1 by Prototype Building.

Figure III shows the site Energy Cost Index (ECI) for the IECC-based 2023 FBCEC and the IECC-2021 codes by prototype building types. The annual site ECI weighted across the sixteen prototype buildings was 1.164 $/ft^2-yr and 1.149 $/ft^2-yr for the IECC-based 2023 FBCEC and the 2021IECC, respectively. The annual average site ECI of the IECC-based 2023 FBCEC was higher than that of the 2021 IECC building by about 1.30 percent. The predicted annual site ECI values also demonstrate that commercial buildings constructed in accordance with the 2023 FBCEC have slightly higher operating energy costs than those of the 2021 IECC. This increased energy cost is primarily due to excluding the automatic receptacle control, secondary sidelight area control, and stringent fenestration requirements from the IECC-based 2023 FBCEC.

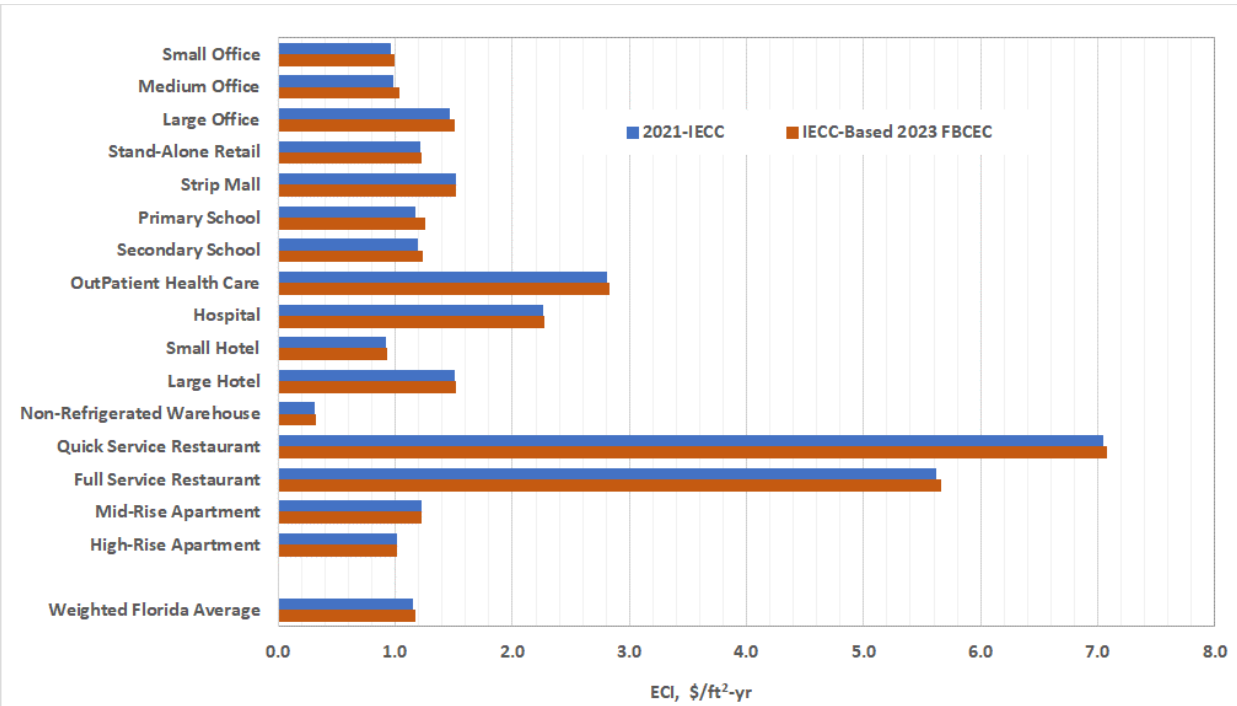

Figure III Site ECI of the IECC-Based 2023 FBCEC and 2021 IECC by Prototype Building

The ASHRAE 90.1-based 2023 FBCEC and the 2019 ASHRAE 90.1-2019 building energy codes predicted annual site Energy Cost Index (ECI) by prototype building types are shown in Figure IV. The annual site EUI aggregated across the sixteen prototype buildings was determined to be 1.176 $/ft^2-yr and 1.171 $/ft^2-yr for the ASHRAE 90.1-based 2023 FBCEC and the 2019 ASHRAE 90.1 code, respectively. The average annual site ECI of the ASHRAE 90.1-based 2023 FBCEC was higher than that of the ASHRAE 90.1-2019 code by about 0.47 percent. The ECI analysis demonstrates that commercial buildings constructed per the ASHRAE 90.1-based 2023 FBCEC are also slightly less stringent than the 2019 ASHRAE 90.1. This lag is also due to the exclusion of automatic receptacle control requirements from the ASHRAE 90.1-based 2023 FBCEC.

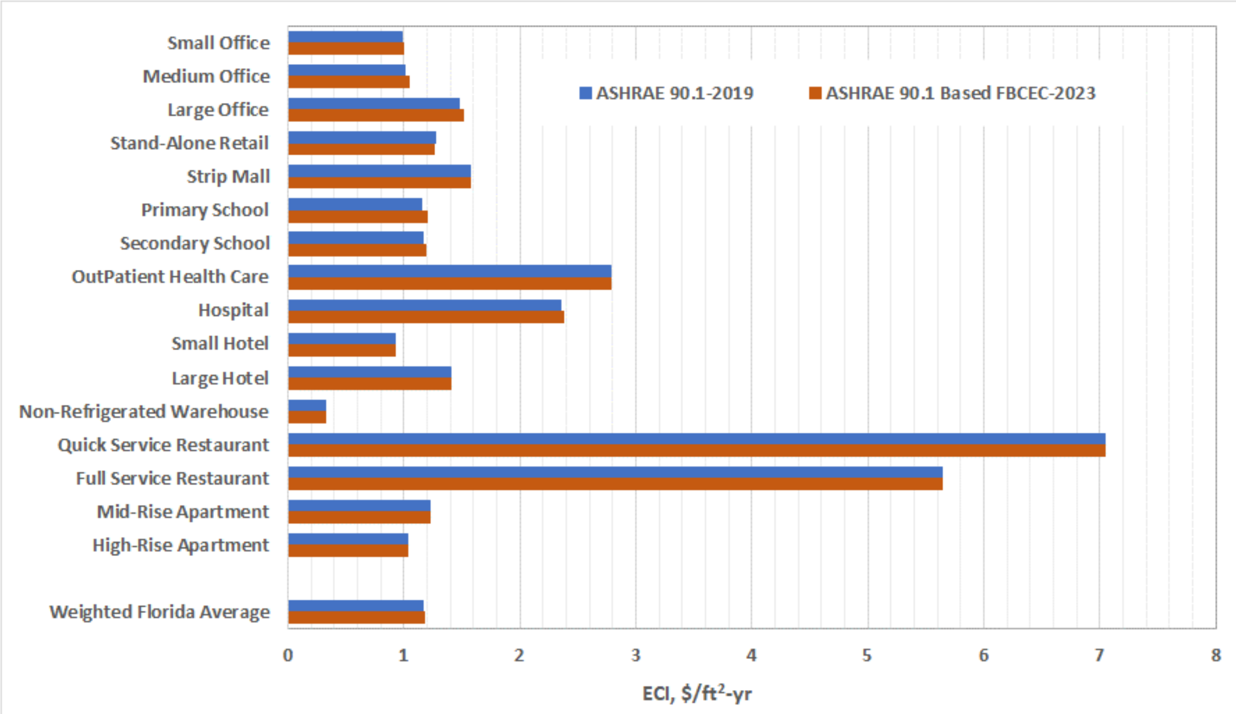

Figure IV Site ECI of the ASHRAE-Based 2023 FBCEC and 2019 ASHRAE 90.1 by Prototype Building

The quantitative analysis demonstrated that the 2023 FBCEC slightly lags behind the 2021 IECC and the 2019 ASHRAE Standard 90.1 national building energy codes. The average annual site EUIs of the 2023 FBCEC and the two US national building energy codes are shown in Figure V. The average annual site EUI values were split by Lighting, HVAC, and Other components of building energy use. Other include appliances, receptacles, service water heaters, pumps, and plant equipment.

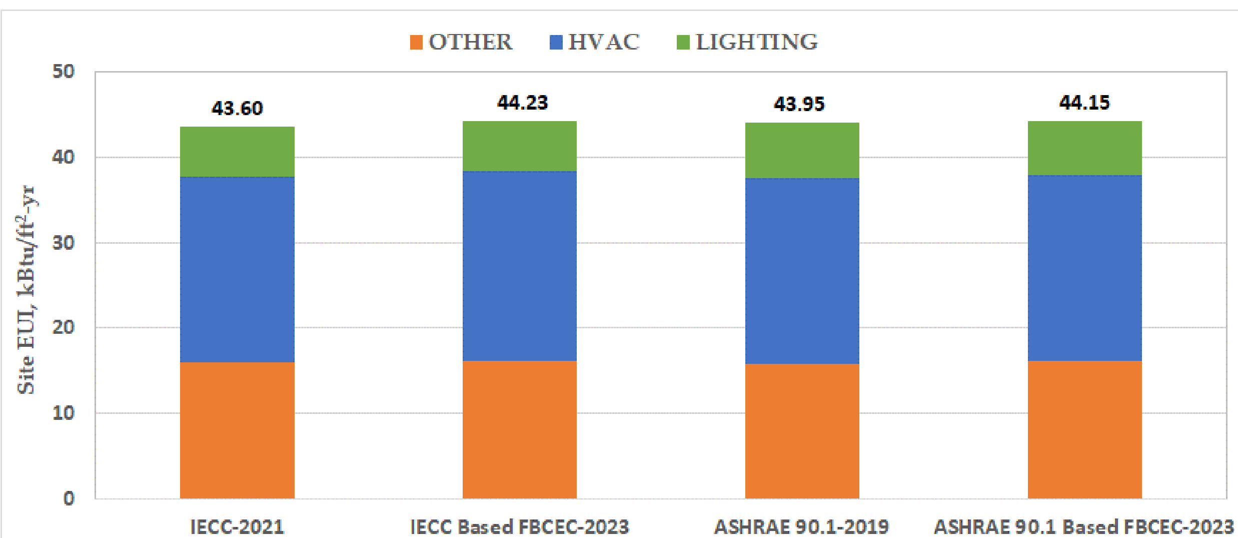

Figure V Average Site EUIs of the 2023 FBCEC and National Building Energy Codes

In summary, the EUI and ECI values of the IECC-based 2023 FBCEC were higher by 1.43% and 1.30%, respectively, compared to the 2021 IECC. In contrast, the ASHRAE 90.1-based 2023 FBC EUI and ECI were higher by 0.45% and 0.47%, respectively, compared to the 2019 ASHRAE Standard 90.1. The quantitative analysis demonstrates that the 2023 FBCEC slightly lags behind the US national building energy codes.

Acknowledgments

This report was prepared by the Florida Solar Energy Center/University of Central Florida for the Florida Department of Business and Professional Regulation (DBPR). The authors would like to thank Mo Madani and the DBPR staff for their support and guidance during the project.

Acronyms and Abbreviations

ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
DOE	U.S. Department of Energy
ECI	Annual Energy Cost Index, $/(ft^2-yr)
EUI	Annual Energy Utilization Intensity, kBtu/(ft^2-yr)
FBCEC	Florida Building Code, Energy Conservation
FBCEC-2023	2023 Florida Building Code, Energy Conservation
FSEC	Florida Solar Energy Center
HVAC	Heating, ventilation, and air-conditioning
IES	Illuminating Engineering Society of North America
IECC	International Energy Conservation Code
PNNL	Pacific Northwest National Laboratory
X	The EUI or ECI value of a building

Simulation Prototype Terminology

IECC-Based 2023 FBCEC	is a building energy model designed to simulate the 8th Edition (2023) FBCEC, which is IECC-based.
ASHRAE 90.1-Based *2023* FBCEC	is a building input designed to simulate the 8th Edition (2023) FBCEC, the 2019 ASHRAE Standard 90.1 compliance option.
ASHRAE 90.1-2019	is a building energy model that simulates the 2019 ASHRAE standard 90.1.
IECC-2021	is a building energy model that simulates the 2021 IECC.

Contents

Executive Summary ... v
Acknowledgments ... x
Acronyms and Abbreviations ... xi
1. Introduction ... 1
2. The 2023 Florida Building Energy Code ... 3
2.1 The 2023 IECC-Based Florida Energy Code ... 3
2.2 The 2023 ASHRAE-Based Florida Building Energy Code ... 4
3. Florida Climate Zones ... 5
4. Quantitative Analysis of the 2023 Florida Energy Code Performance ... 5
4.1 Prototype Buildings and Floor Area Distribution ... 7
4.2 Annual Energy Use of IECC Based 2023 Florida Energy Code ... 9
4.3 Energy Cost Index of the IECC Based 2023 Florida Energy Code ... 11
4.4 Annual Energy Use of the ASHRAE Based 2023 Florida Energy Code ... 13
4.5 Energy Cost Index of the ASHRAE Based 2023 Florida Energy Code ... 15
5. Energy Impact Summary of the 2023 Florida Energy Code ... 17
6. Conclusion ... 20
7. Reference ... 21
Appendix-A: The IECC-Based 2023 Florida Energy Code Changes with Energy Impact ... 22
Appendix-B: The ASHRAE 90.1–Based 2023 Florida Energy Code Changes with Energy Impact ... 38
Appendix-C: Florida Energy Rates ... 51
Appendix-D: Florida Commercial Building Floor Area Distribution ... 54

List of Figures

Figure 1 Commercial Prototype Buildings Type and Floor Area Distribution in Florida 7
Figure 2 Site EUI of the 2023 2023 and IECC-2021 FBCEC by Prototype Building 9
Figure 3 Site ECI for the 2023 FBCEC and IECC-2021 by Prototype Building 12
Figure 4 Site EUI of the ASHRAE-Based 2023 FBCEC and ASHRAE 90.1-2019 by Prototype Building . 14
Figure 5 Site ECI of the ASHRAE-Based 2023 FBCEC and ASHRAE 90.1-2019 by Prototype Building . 15
Figure 6 Average site EUIs of the 2023 FBCEC and National Building Energy Codes 18

List of Tables

Table 1 Distribution of Code Modifications Included in the 2023 FBCEC 3
Table 2 Number of code changes addenda to ASHRAE Standard 90.1 - 2016... 4
Table 3 Commercial Prototype Buildings Type and Floor Area Distribution in Florida................................ 8
Table 4 Site EUI of the 2023 FBCEC and IECC-2021 by Prototype Building 10
Table 5 The 2021 IECC Code Changes Excluded from 2023 FBCEC.. 11
Table 6 Site ECI of the 2023 FBCEC and IECC-2021 by Prototype Building 12
Table 7 Site EUI of the 2023 FBCEC and ASHRAE 90.1-219 by Prototype Building 14
Table 8 Site ECI of the 2023 FBCEC and ASHRAE 90.1-2019 by Prototype Building 16
Table 9 Site EUI of the 2023 FBCEC and National Building Energy Code by Prototype Building 17
Table 10 Excluded Code Modifications Impacting the 2023 FBCEC Energy Performance 18

1. Introduction

The state of Florida desires to review provisions of the 8th Edition (2023) commercial buildings energy code to determine if it meets or exceeds the 2021 IECC and the 2019 ASHRAE 90.1 code. This report summarizes the analysis and evaluation to decide whether the 2023 Florida Building Code, Energy Conservation (FBCEC) meets or exceeds the 2021 IECC and the 2019 ASHRAE 90.1 code. FSEC reviewed and compared the 8th Edition (2023) FBCEC code modifications against the 2021 IECC and the 2019 ASHRAE 90.1 for qualitative and quantitative analysis. Identified the code changes with energy impact and determined the suitability of the changes for quantitative analysis using a building energy simulation program.

The sixteen IECC-based 2020 Florida commercial prototype building energy models initially created by PNNL (DOE, 2018) and later modified by FSEC for the 7th Edition (2020) FBCEC were reviewed. Starting with these prototype building energy models, updated the input assumptions and developed the IECC-based 2023 FBCEC equivalent prototype building energy models for climate zones 1A and 2A. The code modifications quantitative analysis covered the Building Envelope, Building Mechanical Systems, Service Water Heating, and Electric Power and Lighting sections of the Florida Commercial Energy Code. This study requires identifying how best to represent the code modification in the prototype building models, performing sizing calculations, and identifying and updating the various minimum efficiency requirements. This step was repeated for the 2021 IECC code, the sixteen prototype buildings, and the two Florida climate zones. The code modifications included in the quantitative analysis of the IECC-based 2023 FBCEC were summarized in Appendix A.

The latest DOE ASHRAE 90.1-2019 sixteen reference prototype buildings model energy codes for climate zones 1A and 2A (DOE, 2020) were obtained and modified for Florida's climate zones 1A and 2A. Modified climate zone 2A building energy models site location to Orlando, Florida, and updated climate zone and location-dependent model parameters. The ASHRAE 90.1-2019 prototype buildings energy models were transitioned to EnergyPlus version 9.6. The code modifications included in the quantitative analysis of the ASHRAE 90.1-based 2023 FBCEC were summarized in Appendix B. The ASHRAE 90.1-based 2023 FBCEC prototype models were created from the ASHRAE 90.1-2019 prototype buildings energy models by excluding the impacts of Section 8.4.2 Automatic receptacle control and replacing Section 9.4.1.1(g) Automatic partial-off interior lighting control with automatic full-off.

The electric[1] and natural gas[2] standard energy rates obtained from the Florida Power and Light and Florida City Gas were used in the analysis and are summarized in Appendix C. Finally, the prototype building models of the IECC-based and ASHRAE 90.1-based 2023 FBCEC and the two US national building energy code models were simulated for the two Florida climate zones using the EnergyPlus whole-building energy simulation program.

Processed the EnergyPlus program output and determined the annual site Energy Utilization Intensity (EUI) and Energy Cost Index (ECI) for each prototype building, two climate zones, and the IECC-based 2023 FBCEC, ASHRAE 90.1-based 2023 FBCEC, and the two US national building energy codes. The EUIs and ECIs of the prototype buildings were weighed by Florida

[1] https://www.fpl.com/rates/pdf/electric-tariff-section8.pdf
[2] https://www.floridacitygas.com/fcgcommon/pdfs/FACT-SHEET-FCG-Rates.pdf

climate zone floor area weighting factors and aggregated across the sixteen commercial buildings to determine an average annual site EUI and ECI values for the two 2023 Florida commercial building energy codes and the two US national building energy codes analyzed.

The 2023 FBCEC's energy performance relative to the 2021 IECC and the 2019 ASHRAE 90.1 US national building energy codes was quantified by comparing the EUIs and ECIs of the commercial prototype building models. The report also provided an energy performance comparison summary based on an aggregate EUI and ECI for the two Florida commercial building energy codes and the US national building energy codes.

2. The 2023 Florida Building Energy Code

The 8th Edition (2023) FBCEC modifications to the base code, which is the 7th Edition (2020) FBCEC, were reviewed, and code changes with energy impact were identified. The list of code changes with energy impact included in the 2023 FBCEC and a brief description of the code modification is provided in Appendix-A and Appendix-B for IECC and ASHRAE 90.1-based codes, respectively.

2.1 The 2023 IECC-Based Florida Energy Code

The 8th Edition (2023) FBCEC code changes were reviewed and compared with the IECC-based 7th Edition (2020) FBCEC and the 2021 IECC. The Florida Building Commission approved 103 code modifications and included them in the 8th Edition FBCEC. A summary of the code change distribution by code sections is shown in Table 1. Building mechanical system, electric power, and lighting sections of code modifications cover 78.6% of the 2023 FBCEC total code changes investigated, while the remaining 21.4% represent scope and administrations, definitions, building envelope, service water heating, and existing buildings.

Table 1 Distribution of Code Modifications Included in the 2023 FBCEC

Commercial Code Section	Code Changes, Count
Chapter C1: Scope and Administration	3
Chapter C2: Definitions	11
Chapter C3: General Requirements	2
Chapter C4: Commercial Energy Efficiency	81
Chapter C5: Existing Buildings	3
Appendix CC: Electric Vehicle Charging Provisions For New Commercial Construction	1
Appendix CD: Board of Appeals—Commercial	1
Appendix CE: Zero Code Renewable Energy Standard	1
Total	103

The IECC-based 2023 FBCEC changes review identified twenty-five code modifications with energy impact, and thirteen were quantitatively analyzed using the sixteen commercial prototype building energy models. A brief description of each code change with Energy impact included in the 8th Edition (2023) FBCEC relative to the 7th Edition (2020) FBCEC is summarized in Appendix A. Also worth noting is that the 2021 IECC has five energy-impactful code modifications excluded from the 2023 FBCEC. These changes excluded from the IECC-based 2023 FBCEC were automatic receptacle control, secondary sidelight area control functions, increased stringency for fenestration SHGC and U-Factor, increased stringency for opaque swinging door U-Factors, and addition of Energy Recovery Ventilator (ERV) requirement in multi-family buildings and are summarized in Table 5.

2.2 The 2023 ASHRAE-Based Florida Building Energy Code

The ASHRAE 90.1-based 2023 FBCEC code changes were reviewed and compared with the 2019 ASHRAE 90.1 based on the code addenda published in informative appendix I of the 2019 ASHRAE Standard 90.1. The qualitative analysis also identified the energy impact of the code modifications. This section summarizes the code changes based on the review of the addenda to ASHRAE 90.1-2016 (ASHRAE, 2019) and compares the previous (ASHRAE, 2016) and current (ASHRAE, 2019) of ASHRAE Standard 90.1. Table 2 summarizes the number of changes by code sections and those changes that directly impact building energy use. A brief description of each of the addenda with energy impact is summarized in Appendix B.

Table 2 Number of code changes addenda to ASHRAE Standard 90.1 - 2016

Section	Number of Addenda	Number of Addenda with Energy Impact
3. Definitions, Abbreviations, and Acronyms	4	-
4. Administration and Enforcement	4	-
5. Building Envelope	6	1
6. Heating Ventilation and Air Conditioning	33	20
7. Service Water Heating	1	1
8. Power	-	-
9. Lighting	10	7
10. Other Equipment	1	1
11. Energy Cost Budget Method	5	1
12. Normative References	2	-
13. Appendices A – G	22	4
Total	88	35

Eighty-eight code changes were included in the 2019 ASHRAE Standard 90.1. Of the eighty-eight additions, thirty-five were identified to have an impact on energy use. Twenty of the thirty-five changes were identified as suitable for the quantitative analysis using a building energy simulation program. The twenty code changes were analyzed to determine the ASHRAE 90.1-2019 code energy impact on the State of Florida energy code. The 8th Edition (2023) FBCEC excludes Section 8.4.2 Automatic Receptacle Control, Section 8.4.3 of Electrical Energy Monitoring, and Section 9.4.1.1(g) Interior Lighting Automatic Partial-Off of the 2019 ASHRAE Standard 90.1. However, only impacts of Sections 8.4.2 and 9.4.1.1(g) were excluded from the quantitative analysis of the ASHRAE 90.1-based 2023 FBCEC.

3. Florida Climate Zones

Based on DOE's climate zone classification, Florida has two climate zones: very hot and humid (1A) and hot and humid (2A). Representative site locations for climate zones 1A and 2A selected for the quantitative analysis were Miami, Florida (1A, very hot, humid) and Orlando, Florida (2A, hot, humid). Orlando was selected as a representative site location for Climate Zone 2A mainly because it is the geographic center for large cities in the Climate Zone 2A region of the State. Miami, the largest city in Climate Zone 1A, was selected as a representative site location. The Florida commercial building stock floor area distribution by climate zones and building types and the data used to drive them are provided in Appendix D.

4. Quantitative Analysis of the 2023 Florida Energy Code Performance

The quantitative analysis determined and compared annual total Energy Utilization Intensity (EUI) and annual Energy Cost Index (ECI) by prototype building type and floor area weighted Florida average. Sixteen commercial prototype building types represented the Florida commercial new construction building's total floor area stock. The floor area weighing factors by building type used for the analysis are summarized in Table 3. The annual energy use and energy cost comparison was made between prototype buildings energy model designed with the IECC-based 2023 FBCEC against the 2021 IECC and between the 2019 ASHRAE 90.1-based 2023 FBCEC against the 2019 ASHRAE 90.1 code.

The IECC-based 2023 FBCEC prototype building energy models were developed by modifying the 7th Edition (2020) FBCEC prototype energy models based on the code modifications published in the 2023 FBCEC. The code changes with energy impact included in the 2023 FBCEC are listed in Appendix A. The sixteen prototype commercial buildings energy models of the IECC-based 2023 FBCEC and the 2021 IECC were simulated for Miami and Orlando site locations representing climate zones 1A and 2A, respectively.

The 2019 ASHRAE 90.1 code prototype building energy models were DOE reference prototype building energy model decks published by the Pacific Northwest National Laboratory (PNNL) (DOE, 2020). The DOE reference prototype building energy models were also modified for this study to account for site location and location-dependent parameters such as site water mains temperature and ground temperature. The ASHRAE 90.1-based 2023 FBCEC prototype building energy models were developed by excluding the impacts of ASHRAE 90.1-2019 Section 8.4.2 Automatic Receptacle Controls and Section 9.4.1.1(g) Automatic Partial-off interior lighting control from the DOE reference prototype building energy models. The sixteen prototype commercial buildings energy models of the ASHRAE 90.1 based 2023 FBCEC and the 2019 ASHRAE 90.1 code were simulated for Miami and Orlando site locations.

Finally, the EUI and ECI of the prototype building energy models designed with the 2023 FBCEC, 2021 IECC, and ASHRAE 90.1-2019 code were determined and evaluated. The weighted Florida average site EUI and ECI were calculated from the EUI and ECI of the sixteen commercial prototype buildings using weighting factors that account for the prototype building's floor area distribution by climate zones and building type. The EUI for each prototype building was determined by dividing the annual total energy use of a building by its total floor area. The

ECI for each prototype building was obtained by dividing the total annual energy cost of a building by its total floor area. The total annual energy cost includes electric, demand changes, and natural gas energy costs. The standards energy rates for electricity, demand charges, and natural gas used in this analysis are provided in Appendix C. The EUI and ECI percent difference between the 2023 FBCEC, the 2021 IECC, and the ASHRAE 90.1-2019 US national building energy codes were calculated as follows:

$$\Delta X = 100 \cdot \frac{X_{BaseCode} - X_{FBCEC}}{X_{BaseCode}}$$

Where X represents the EUI or ECI value of a prototype building or an aggregate of the sixteen prototype buildings, $X_{BaseCode}$ represents the EUI or ECI value of a prototype building or a weighted average of the sixteen prototype buildings of the 2021 IECC and the 2019 ASHRAE 90.1 code, and X_{FBCEC} represents EUI or ECI value of a prototype building or a weighted average of the sixteen prototype buildings of the IECC-based and ASHRAE 90.1-based 2023 FBCEC prototype buildings.

4.1 Prototype Buildings and Floor Area Distribution

Quantitative analysis of the Florida commercial building energy code performance was investigated using the sixteen prototype building energy models representing climate zones 1A and 2A. Figure 1 shows the commercial building's total floor area weighting factors used for Florida by prototype buildings. The eight building types and sixteen prototype energy models shown in Table 3 represent the commercial building's stock floor area and floor area distribution by prototype building in Florida.

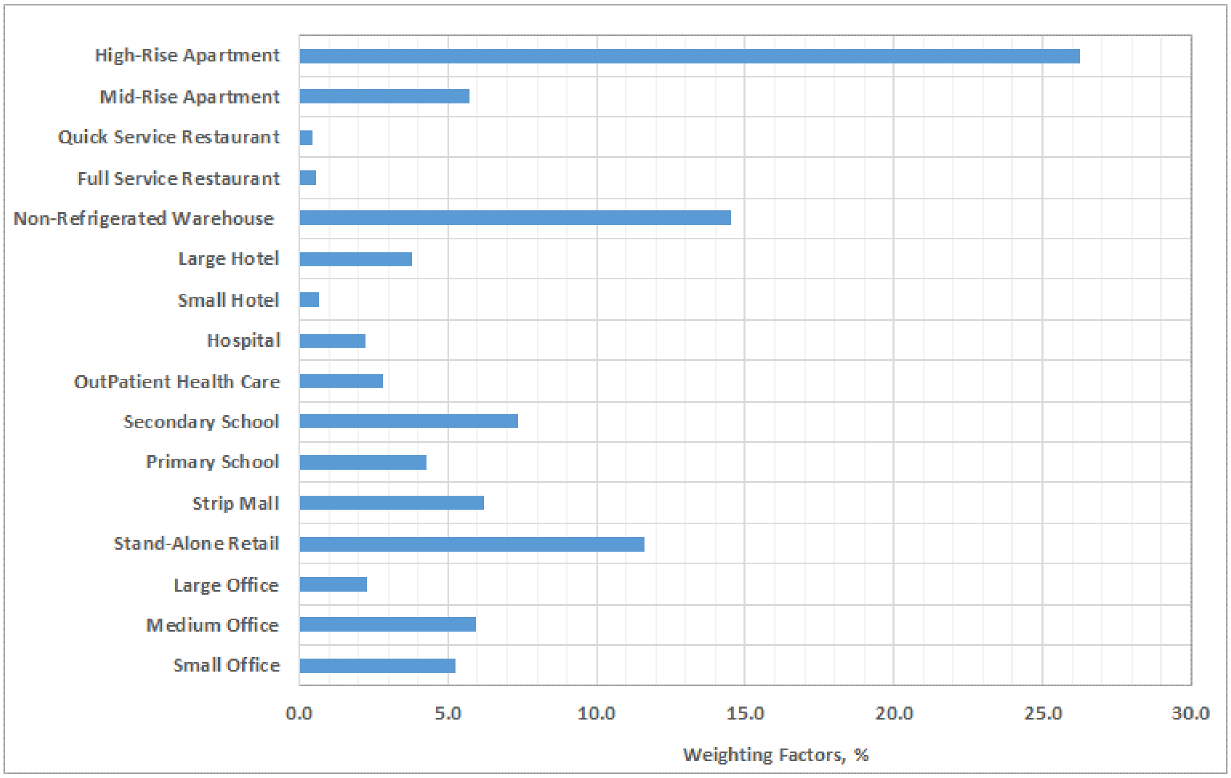

Figure 1 Commercial Prototype Buildings Type and Floor Area Distribution in Florida

The DOE uses the same prototype buildings to represent the US national commercial building stock for building energy use quantitative analysis. They claim these building types represent 80% of the US national commercial building floor area stock (DOE, 2018). The prototype building floor area weighting factors presented here are specific to the State of Florida and were determined as described in Appendix D.

Table 3 Commercial Prototype Buildings Type and Floor Area Distribution in Florida

Building Type	Prototype Building	Prototype Building Floor Area, ft^2	Total Building Floor Area, 1000 ft^2	Floor Area Weighting Factors, %
Office	Small Office	5,502	37,889	5.27
	Medium Office	53,628	42,765	5.94
	Large Office	498,588	16,558	2.30
Retail	Stand-Alone Retail	24,692	83,481	11.60
	Strip Mall	22,500	44,652	6.21
Education	Primary School	73,959	30,815	4.28
	Secondary School	210,887	52,709	7.33
HealthCare	Outpatient Health Care	40,946	20,381	2.83
	Hospital	241,501	16,210	2.25
Lodging	Small Hotel	43,202	4,682	0.65
	Large Hotel	122,120	27,389	3.81
Warehouse	Non-Refrigerated Warehouse	52,045	104,327	14.50
Food Service	Full-Service Restaurant	2,501	4,003	0.56
	Quick Service Restaurant	5,502	3,296	0.46
Apartment	Mid-Rise Apartment	33,741	41,402	5.75
	High-Rise Apartment	84,360	188,913	26.25
Total		1,515,674	719,472	100.00

4.2 Annual Energy Use of IECC Based 2023 Florida Energy Code

The 8th Edition (2023) FBCEC prototype building energy models were created by modifying the 7th Edition (2020) FBCEC models using the fourteen code modifications with energy impact. The code modifications included in the IECC-based 2023 FBCEC and investigated are summarized in Appendix A. Sixteen prototype building models for two climate zones were created for the analysis. There are 32 prototype building energy models, each representing the IECC-based 2023 FBCEC and the 2021-IECC. The relative building energy use performance of the 2023 FBCEC was determined by comparing the site EUI with that of the 2021 IECC by prototype building types and floor area weighted Florida average. The annual site EUIs of each prototype building type were aggregated by Florida climate zone floor area weighing factors to determine the EUI by prototype building type. Figure 2 shows the EUIs of the commercial code prototype buildings designed with IECC-based 2023 FBCEC and the 2021 IECC in Florida. The annual site EUI average across the sixteen commercial prototype buildings was determined to be 44.23 kBtu/ft^2-yr and 43.60 kBtu/ft^2-yr for the IECC-based 2023 FBCEC and the 2021 IECC, respectively.

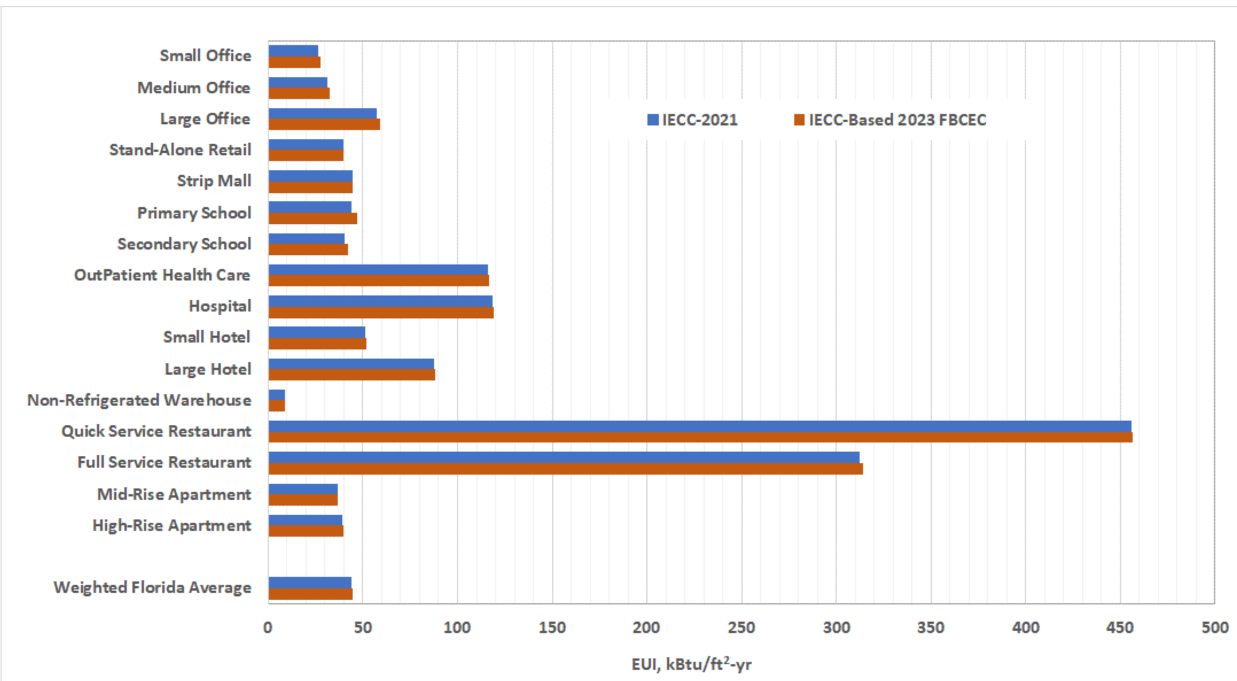

Figure 2 Site EUI of the 2023 2023 and IECC-2021 FBCEC by Prototype Building

The annual site EUI values of the IECC-based 2023 FBCEC and the 2021 IECC by prototype building types and floor area-weighted average for Florida are summarized in Table 4. All the sixteen prototype building energy models of the 2023 FBCEC have EUIs greater than that of the 2021 IECC building model energy code. The weighted average annual energy use performance determined for the IECC-based 2023 FBCEC indicates that it lags behind the 2021 IECC by 1.43 percent. This lag is primarily due to excluding five code modifications with significant energy impacts.

Table 4 Site EUI of the 2023 FBCEC and IECC-2021 by Prototype Building

Building Type	Weighting Factors, %	2021-IECC EUI, kBtu/ft^2-yr	IECC Based 2023 FBCEC EUI, kBtu/ft^2-yr	ΔEUI, %
Small Office	5.27	26.04	27.04	-3.82
Medium Office	5.94	30.69	32.34	-5.36
Large Office	2.30	57.08	58.62	-2.70
Stand-Alone Retail	11.60	39.44	39.51	-0.18
Strip Mall	6.21	44.41	44.48	-0.15
Primary School	4.28	43.55	46.95	-7.80
Secondary School	7.33	39.96	41.58	-4.06
Outpatient Health Care	2.83	115.83	116.46	-0.55
Hospital	2.25	118.12	118.83	-0.60
Small Hotel	0.65	51.15	51.39	-0.47
Large Hotel	3.81	87.40	87.63	-0.27
Non-Refrigerated Warehouse	14.50	8.40	8.52	-1.40
Full Service Restaurant	0.56	455.29	456.38	-0.24
Quick Service Restaurant	0.46	312.21	313.74	-0.49
Mid-Rise Apartment	5.75	36.23	36.43	-0.53
High-Rise Apartment	26.25	38.99	39.28	-0.75
Weighted Florida Average	100.00	43.60	44.23	-1.43

Table 5 summarizes the five code modifications excluded from the IECC-based 2023 FBCEC. These modifications are included in the prototype model energy code of the 2021 IECC but excluded from the IECC-based 2023 FBCEC. These code changes affect most or all prototype buildings except for the ERV requirement, which was only added for the two multifamily prototype buildings. Thus, the IECC-based 2023 FBCEC is slightly less stringent than the 2021 IECC, primarily due to the exclusion of these impactful code modifications. The most energy-impactful of these code modifications is automatic receptacle control.

Table 5 The 2021 IECC Code Changes Excluded from 2023 FBCEC

2021 IECC Section and Title	ICC Code Change No.	Include in the 2021 IECC Quantitative Analysis, Yes/No	Description
Table C402.1.4 Opaque Thermal Envelope Assembly Maximum Requirements, *U*-Factor Method, C402.5.1 Opaque swinging doors	CE70-19	Yes	It decreases the opaque swinging door U-factor from 0.61 to 0.37 Btu/h-ft2-°F, impacting fourteen prototype buildings in climate zones 1A and 2A.
Table C402.4 Building Envelope Fenestration Maximum U-Factor and SHGC Requirements	CE84-19, CE85-19, CE87-19	Yes	It reduced SHGC and *U*-Factor of fenestrations in all sixteen prototype buildings in climate zones 1A and 2A.
C405.2.4.2 Sidelit daylight zone	CE187-19	Yes	Adds secondary sidelit area control requirement. Impacts thirteen prototype buildings.
C405.11 Automatic Receptacle Control, C405.11.1 Automatic receptacle control function	CE216-19	Yes	It applies reduction factors to the plug load schedules for automatic receptacle control and impacts all sixteen prototype buildings.
C403.7.4.1 Nontransient dwelling units	CE133-19	Yes	Adds ERV requirement for the non-transient dwelling units. Impacts high-rise and mid-rise apartment prototype buildings.

4.3 Energy Cost Index of the IECC Based 2023 Florida Energy Code

Besides the energy use performance comparison, the annual site Energy Cost Index (ECI) of the IECC-based 2023 FBCEC was determined and compared against that of the 2021 IECC. Climate zone weighting factors scaled the ECI of each prototype building to determine the ECI by a prototype building. Figure 3 shows the ECI for commercial prototype buildings designed with the IECC-based 2023 FBCEC and 2021 IECC. The annual site ECI weighted average across the sixteen commercial code prototype building energy models was estimated at 1.164 $\$/ft^2$-yr and 1.149 $\$/ft^2$-yr for the IECC-based 2023 FBCEC and the 2021 IECC. Table 6 summarizes the annual ECIs of the IECC-based 2023 FBCEC and the 2021 IECC by prototype building type. The 2023 FBCEC weighted average annual site ECI is about 0.015 $\$/ft^2$-yr higher. That is, the weighted average annual energy cost performance for the 2023 FBCEC commercial sector surpasses that of the 2021 IECC by 1.30 percent.

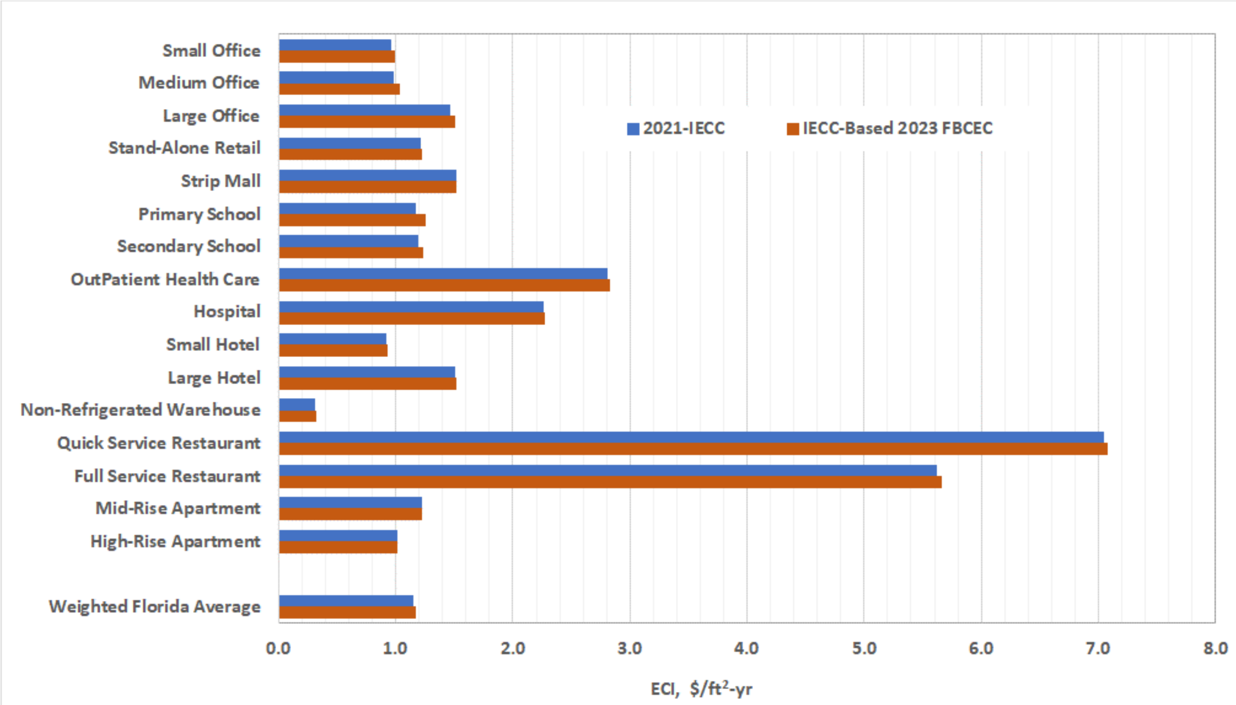

Figure 3 Site ECI for the 2023 FBCEC and IECC-2021 by Prototype Building

Table 6 Site ECI of the 2023 FBCEC and IECC-2021 by Prototype Building

Building Type	Weighting Factors, %	IECC-2021 ECI, $/ft^2-yr	IECC-Based 2023 FBCEC ECI, $/ft^2-yr	ΔECI, %
Small Office	5.27	0.96	0.99	-3.36
Medium Office	5.94	0.98	1.03	-4.38
Large Office	2.30	1.46	1.50	-2.74
Stand-Alone Retail	11.60	1.21	1.21	-0.25
Strip Mall	6.21	1.51	1.51	0.00
Primary School	4.28	1.17	1.25	-7.07
Secondary School	7.33	1.19	1.23	-3.72
Outpatient Health Care	2.83	2.80	2.82	-0.79
Hospital	2.25	2.26	2.27	-0.57
Small Hotel	0.65	0.91	0.92	-1.10
Large Hotel	3.81	1.50	1.51	-0.31
Non-Refrigerated Warehouse	14.50	0.31	0.31	-2.03
Full Service Restaurant	0.56	7.05	7.08	-0.47
Quick Service Restaurant	0.46	5.61	5.66	-0.89
Mid-Rise Apartment	5.75	1.22	1.22	-0.39
High-Rise Apartment	26.25	1.01	1.00	0.05
Weighted Florida Average	100.00	1.149	1.164	-1.30

4.4 Annual Energy Use of the ASHRAE Based 2023 Florida Energy Code

The 8th Edition (2023) Florida Building Code, Energy Conservation, allows ASHRAE Standard 90.1-2019 as a compliance option. However, the 2019 ASHRAE 90.1-Based compliance option of the 2023 FBCEC excludes code sections 8.4.2 Automatic receptacle control, 8.4.3 Energy monitoring, and 9.4.1.1(g) Automatic partial-Off of the 2019 ASHRAE 90.1 standard. This analysis compares the ASHRAE 90.1 based on the 2023 FBCEC against the 2019 ASHRAE 90.1 Standard. Sixteen prototype buildings and two climate zones were used for the analysis. There are 32 prototype building energy models, each representing the ASHRAE 90.1-based 2023 FBCEC and the 2019-ASHRAE 90.1 Code.

The twenty code modifications with energy impact included in the quantitative analysis for the 2019 ASHRAE 90.1 are summarized in Appendix B. ASHRAE Standard 90.1-2019 code requires automatic receptacle control in space types such as private offices, conference rooms, printing and copying rooms, classrooms, break rooms, and private workstations (ASHRAE, 2019). All the sixteen DOE commercial prototype buildings of the 2019 ASHRAE Standard 90.1 have automatic receptacle control. Automatic receptacle control in ASHRAE 90.1-2019 code buildings' energy models was accounted for using reduced hourly fractions for receptacle loads. Section 8.4.3 Energy monitoring is not amenable to simulation-based quantitative analysis; hence, it is not included in the prototype building energy models.

Prototype building models of the ASHRAE 90.1-based 2023 FBCEC buildings were created by removing the interior lighting automatic partial-off section 9.4.1.1(g) and the automatic receptacle control section 8.4.2 from the 2019 ASHRAE 90.1 DOE reference prototype building models. The automatic receptacle control impacts all the sixteen prototype buildings. The automatic full-off control replaced the partial-off interior lighting control in ten prototype building models.

The Energy Utilization Intensity (EUI) of each prototype building for each climate zone was aggregated by Florida climate zone floor area weighing factors to determine the EUI by prototype building. The energy performance of the ASHRAE 90.1-based 2023 FBCEC was determined by comparing the annual site EUIs against the 2019 ASHRAE 90.1 standard by prototype buildings. EUI of the prototype buildings weighted by climate zones and commercial buildings' floor area stock are summarized in Table 7. Most ASHRAE 90.1-based 2023 FBCEC prototype building models use higher energy than the ASHRAE 90.1-2019 code. Florida's average EUI of the ASHRAE 90.1-based 2023 FBCEC was higher by about 0.45% relative to the ASHRAE 90.1-2019 national building energy code.

The annual site EUI plots of the ASHRAE 90.1-based 2023 FBCEC, and the 2019 ASHRAE 90.1 standard by prototype buildings are shown in Figure 4. Most of the 2023 FBCEC prototype building energy models of ASHRAE 90.1 code consume slightly higher energy primarily due to the exclusion of Section 8.4.2 Automatic receptacle control. This study determined that the 2023 FBCEC ASHRAE 90.1-2019 compliance option designated ASHRAE 90.1-based 2023 FBCEC aggregate energy use lags behind the 2019 ASHRAE 90.1 code by 0.45 percent.

Table 7 Site EUI of the 2023 FBCEC and ASHRAE 90.1-219 by Prototype Building

Building Type	Weighting Factors, %	ASHRAE 90.1-2019 kBtu/ft^2-yr	ASHRAE 90.1-Based 2023 FBCEC, kBtu/ft^2-yr	ΔEUI, %
Small Office	5.27	26.74	27.30	-2.09
Medium Office	5.94	31.63	32.70	-3.39
Large Office	2.30	57.69	58.75	-1.84
Stand-Alone Retail	11.60	41.51	41.22	0.69
Strip Mall	6.21	46.60	46.28	0.69
Primary School	4.28	43.42	45.53	-4.85
Secondary School	7.33	39.73	40.40	-1.70
Outpatient Health Care	2.83	112.18	112.45	-0.24
Hospital	2.25	102.84	103.65	-0.79
Small Hotel	0.65	51.41	51.50	-0.18
Large Hotel	3.81	83.35	83.42	-0.08
Non-Refrigerated Warehouse	14.50	9.21	8.89	3.41
Full Service Restaurant	0.56	456.44	456.44	0.00
Quick Service Restaurant	0.46	313.97	313.94	0.01
Mid-Rise Apartment	5.75	36.32	36.38	-0.14
High-Rise Apartment	26.25	40.35	40.38	-0.07
Weighted Florida Average	100.00	43.95	44.15	-0.45

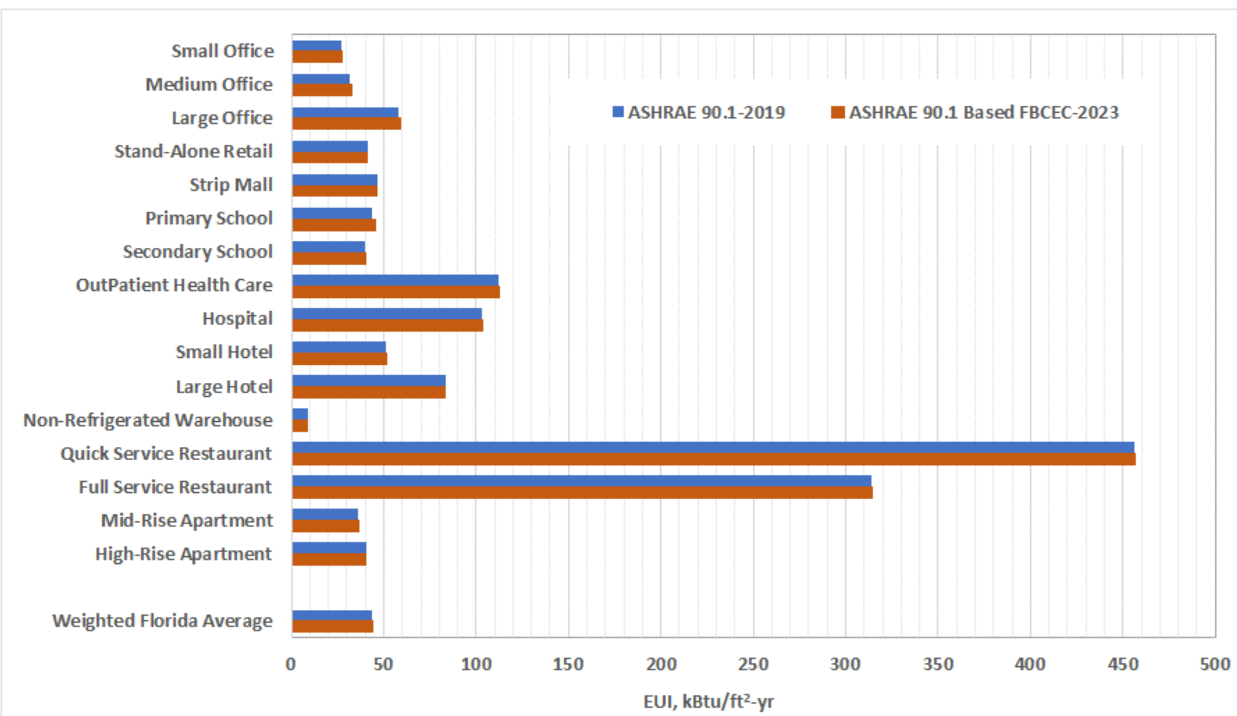

Figure 4 Site EUI of the ASHRAE-Based 2023 FBCEC and ASHRAE 90.1-2019 by Prototype Building

4.5 Energy Cost Index of the ASHRAE Based 2023 Florida Energy Code

In addition to the energy use performance comparison, the total annual Energy Cost Index (ECI) of the ASHRAE 90.1-based 2023 FBCEC prototype building energy models was compared against that of the ASHRAE 90.1-2019 code. Florida climate zone weighting factors scaled the Energy Cost Indices (ECIs) of each prototype building to determine the ECIs by prototype building. Figure 5 shows the ECIs for commercial prototype buildings designed with the ASHRAE 90.1-based 2023 FBCEC and ASHRAE 90.1-2019 code. The Florida average ECI was determined by aggregating the sixteen commercial prototype buildings' ECI using weighting factors that account for the state’s commercial building floor area distribution by the climate zones and prototype buildings. The Florida average ECI for the commercial sector was estimated to be 1.176 $/ft^2-yr and 1.171 $/ft^2-yr for the ASHRAE 90.1-based 2023 FBCEC and the 2019 ASHRAE 90.1 code, respectively.

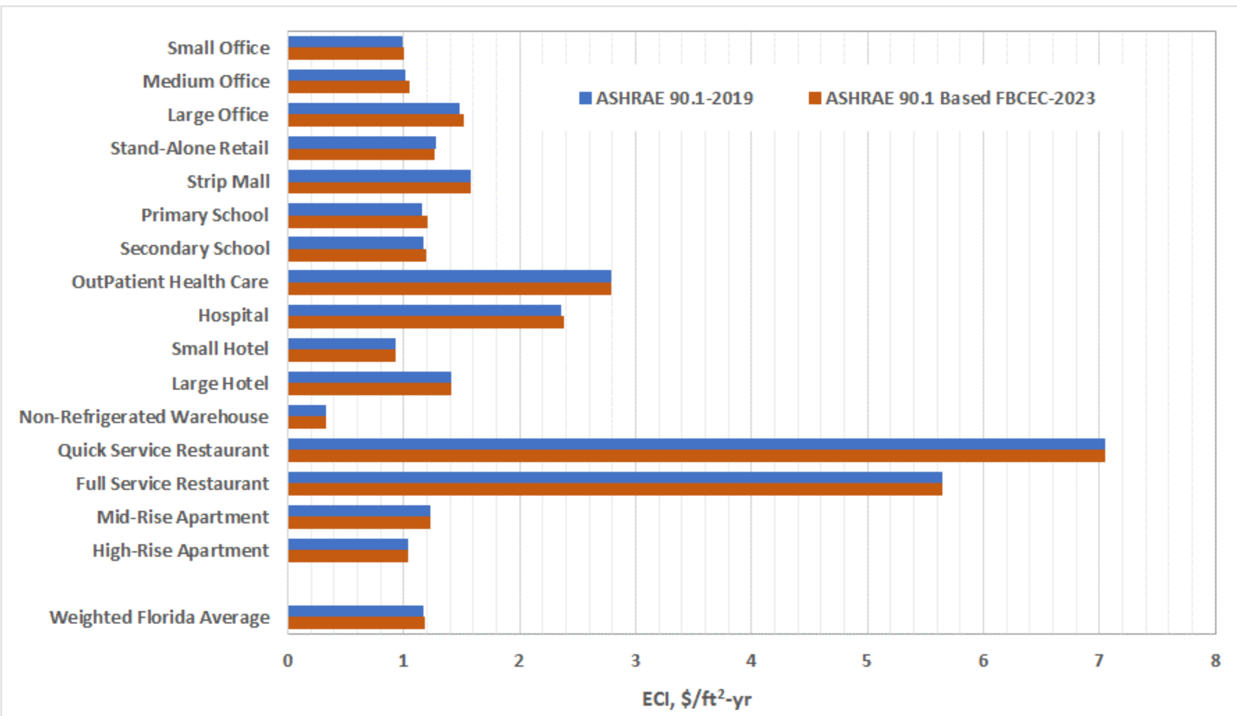

Figure 5 Site ECI of the ASHRAE-Based 2023 FBCEC and ASHRAE 90.1-2019 by Prototype Building

Table 8 summarizes the annual site's Energy Cost Index (ECI) of the ASHRAE 90.1-based 2023 FBCEC and the 2019 ASHRAE 90.1 prototype building models, including the percent differences. The ASHRAE 90.1-based 2023 FBCEC weighted average annual ECI, an aggregate of Florida's sixteen commercial prototype buildings, is higher by about 0.47%.

Table 8 Site ECI of the 2023 FBCEC and ASHRAE 90.1-2019 by Prototype Building

Building Type	Weighting Factors, %	ASHRAE 90.1-2019 ECI, $/ft²-yr	ASHRAE 90.1-Based 2023 FBCEC ECI, $/ft²-yr	ΔECI, %
Small Office	5.27	0.98	1.00	-2.04
Medium Office	5.94	1.02	1.05	-2.95
Large Office	2.30	1.48	1.51	-2.03
Stand-Alone Retail	11.60	1.27	1.26	0.79
Strip Mall	6.21	1.57	1.57	0.22
Primary School	4.28	1.16	1.21	-4.32
Secondary School	7.33	1.17	1.18	-1.20
Outpatient Health Care	2.83	2.78	2.79	-0.36
Hospital	2.25	2.35	2.37	-0.85
Small Hotel	0.65	0.92	0.92	0.0
Large Hotel	3.81	1.40	1.40	0.0
Non-Refrigerated Warehouse	14.50	0.33	0.32	1.15
Full Service Restaurant	0.56	7.05	7.05	0.0
Quick Service Restaurant	0.46	5.63	5.63	0.0
Mid-Rise Apartment	5.75	1.22	1.22	0.0
High-Rise Apartment	26.25	1.04	1.04	0.0
Weighted Florida Average	100.00	1.171	1.176	-0.47

5. Energy Impact Summary of the 2023 Florida Energy Code

This section summarizes the energy use performance of the 2023 FBCEC, the 2021 IECC, and the 2019 ASHRAE 90.1 code. The 2023 FBCEC has two compliance options: the IECC-based 2023 FBCEC and the ASHRAE 90.1-based 2023 FBCEC. The IECC-based 2023 FBCEC excludes five code modifications listed in Table 5, which are included in the 2021 IECC. The ASHRAE 90.1-based 2023 FBCEC is the same as the 2019 ASHRAE 90.1 code, except it excludes Sections 9.4.1.1(g) Interior lighting automatic partial-off, 8.4.2 Automatic receptacle control, and 8.4.3 Energy Monitoring. The EUIs of the 2023 FBCEC and the US national building energy codes predicted using a whole building simulation program, sixteen prototype buildings, and two climate zones representing the State's commercial building sector are summarized in Table 9. The quantitative analysis demonstrated that the IECC-based 2023 FBCEC annual site's energy use performance lags behind the 2021 IECC by about 1.43 percent. In contrast, the ASHRAE 90.1-based 2023 FBCEC, a modified version of the AHREA 90.1-2019 code, annual site energy use performance lags behind the 2019 ASHRAE 90.1 by about 0.45 percent.

Table 9 Site EUI of the 2023 FBCEC and National Building Energy Code by Prototype Building

Building Type	IECC-2021, kBtu/ft^2-yr	IECC-Based 2023 FBCEC, kBtu/ft^2-yr	ASHRAE 90.1-2019, kBtu/ft^2-yr	ASHRAE 90.1-Based 2023 FBCEC, kBtu/ft^2-yr
Small Office	26.04	27.04	26.74	27.30
Medium Office	30.69	32.34	31.63	32.70
Large Office	57.08	58.62	57.69	58.75
Stand-Alone Retail	39.44	39.51	41.51	41.22
Strip Mall	44.41	44.48	46.60	46.28
Primary School	43.55	46.95	43.42	45.53
Secondary School	39.96	41.58	39.73	40.40
Outpatient Health Care	115.83	116.46	112.18	112.45
Hospital	118.12	118.83	102.84	103.65
Small Hotel	51.15	51.39	51.41	51.50
Large Hotel	87.40	87.63	83.35	83.42
Non-Refrigerated Warehouse	8.40	8.52	9.21	8.89
Full Service Restaurant	455.29	456.38	456.44	456.44
Quick Service Restaurant	312.21	313.74	313.97	313.94
Mid-Rise Apartment	36.23	36.43	36.32	36.38
High-Rise Apartment	38.99	39.28	40.35	40.38
Weighted Florida Average	43.60	44.23	43.95	44.15

Figure 6 summarizes the average annual site's EUIs comparison of the IECC-based 2023 FBCEC, the ASHRAE 90.1-based 2023 FBCEC, the 2021 IECC, and the 2019 ASHRAE 90.1 code. It is evident that the 2023 FBCEC slightly lags behind the 2021 IECC and the 2019 ASHRAE 90.1 because selected impactful code changes were excluded from the 2023 FBCEC.

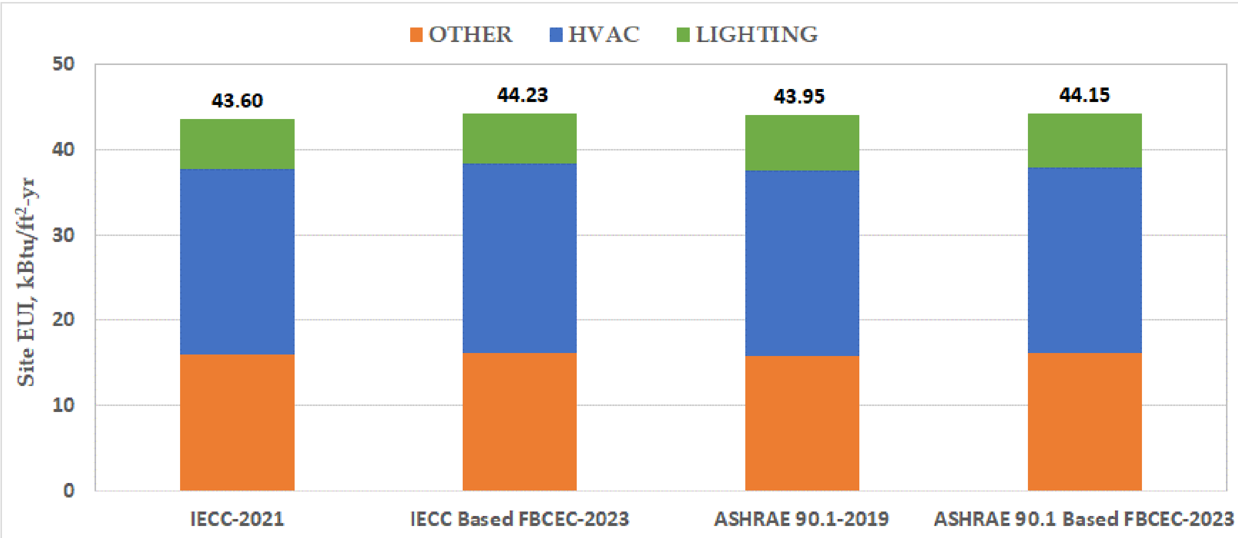

Figure 6 Average site EUIs of the 2023 FBCEC and National Building Energy Codes

Code modifications included in the 2021 IECC and ASHRAE 90.1-2019 US national building energy codes but excluded from the 2023 FBCEC are summarized in Table 10. The exclusion of these codes from the 2023 FBCEC reduced its energy performance relative to the US national building energy codes. These code modifications impact most prototype buildings in both climate zones, slightly dragging the energy performance of the 2023 FBCEC behind the US national building energy codes.

Table 10 Excluded Code Modifications Impacting the 2023 FBCEC Energy Performance

2023 FBCEC and National Energy Codes	Automatic receptacle control. It affects all sixteen prototype buildings.	Secondary sidelit area control. It affects thirteen prototype buildings.	Adds ERV requirement for the non-transient dwelling units. It involves two apartment prototype buildings.	Decreases opaque swinging door U-Factor from 0.61 to 0.37 Btu/h-ft^2-°F. It affects all sixteen prototype buildings.	Reduced SHGC and U-Factor of fenestrations. Affects all sixteen prototype buildings in climate zones 1A	Interior Light Automatic Partial-off. It impacts ten prototype buildings.
IECC-2021	x	x	x	x	x	
IECC-Based 2023 FBCEC						
ASHRAE 90.1-2019	x					x
ASHRAE 90.1-Based 2023 FBCEC						

6. Conclusion

The overall result of quantitative analysis aggregated across the commercial section shows that the 8th Edition (2023) Commercial Florida Building Code, Energy Conservation (FBCEC) was determined to be slightly less stringent than that of the 2021 IECC and the 2019 ASHRAE Standard 90.1 energy code. This determination was made by simulating model energy codes of the sixteen commercial prototype buildings for each climate zone and code. The sixteen prototype building energy models were created for the Florida climate zones (1A and 2A), the IECC-based and ASHRAE 90.1-based 2023 FBCEC, and the US national building energy codes. Thirty-two prototype building models represent each code. The annual site's Energy Utilization Intensity (EUI) and the Energy Cost Index (ECI) were determined for each of the sixteen prototype buildings by climate zone. The State's average EUI and ECI were determined by weighing commercial prototype building floor area stock distribution by the climate zones in the State.

The IECC-Based 2023 FBCEC and the 2021-IECC average EUIs were determined to be 44.23 kBtu/ft^2-yr and 43.60 kBtu/ft^2-yr, respectively. The ASHRAE 90.1-Based 2023 FBCEC and the 2019 ASHRAE 90.1 code average EUIs were 44.15 kBtu/ft^2-yr and 43.95 kBtu/ft^2-yr, respectively. This analysis determined that the 2023 FBCEC average EUI and ECI were slightly higher than that of the 2021 IECC and the 2019 ASHRAE 90.1 national building energy codes. The quantitative analysis demonstrated that the IECC-based 2023 FBCEC site's annual energy use was higher than the 2021 IECC by about 1.43 percent. In contrast, the ASHRAE 90.1-based 2023 FBCEC, a modified version of the ASHRAE Standard 90.1-2019 code, annual site's energy use was higher than that of the 2019 ASHRAE Standard 90.1 by about 0.45 percent.

The higher energy use or the lag of energy performance of the 2023 FBCEC relative to the 2021 IECC and the 2019 ASHRAE Standard 90.1 US national building energy codes is due to the exclusion of energy impactful code modifications. The most energy-impactful change among the excluded code modifications is the automatic receptacle control, which affects all the sixteen prototype building models and amounts to about 65% of the EUI difference determined through the analysis. The quantitative analysis demonstrates that the 2023 FBCEC slightly lags behind the 2021 IECC and the 2019 ASHRAE 90.1 US national building energy codes.

7. Reference

ASHRAE. 2019. ANSI/ASHRAE/IES Standard 90.1-2019. Energy Standard for Buildings Except Low-Rise Residential Buildings. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Atlanta, Georgia.

ASHRAE. 2016. ANSI/ASHRAE/IES Standard 90.1-2016. Energy Standard for Buildings Except Low-Rise Residential Buildings. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Atlanta, Georgia.

Complete Revision History to the 2021 I-Codes. 2020. International Code Council, Inc. http://shop.iccsafe.org/codes/2018-international-codes-and-references/2018-international-building-code-and-references/complete-revision-history-to-the-2018-i-codes-successful-changes-and-public-comments-pdf-download.html.

FBCEC-2023. Florida Building Code, Energy Conservation, 8th Edition (2023). ISBN: 978-1-960701-27-5 (PDF download). International Code Council, Inc. July 2023.

FBCEC-2020. Florida Building Code, Energy Conservation, 7th Edition (2020). ISBN: 978-1-952468-17-9. International Code Council, Inc. July 2020.

IECC. 2018. 2018 International Energy Conservation Code. International Code Council, Inc. Washington, D.C. 2001.

IECC-2021. 2021 International Energy Conservation Code. ISBN: 978-1-60983-961-1 (Soft-cover edition). International Code Council, Inc. January 2021.

Jarnagin, R.E. and G.K. Bandyopadhyay. 2010. Weighting Factors for the Commercial Prototype Buildings Used in the Development of ANSI/ASHRAE/IENSA Standard 90.1-2010. PNNL-19116, Pacific Northwest National Laboratory, Richland, Washington.

U.S. Department of Energy. 2021. EnergyPlus Whole Building Energy Simulation Program, Version 9.6. U.S. Department of Energy, Washington, D.C. Available at https://energyplus.net/.

U.S. Department of Energy. 2017. Energy Savings Analysis: ANSI/ASHRAE/IES Standard 90.1-2016. U.S. Department of Energy, Washington, D.C. Available at https://www.energycodes.gov/sites/default/files/documents/02222018_Standard_90.1-2016_Determination_TSD.pdf.

U.S. Department of Energy. 2020. Building Energy Codes Program, Commercial Prototype Building Models. (2020, October). Commercial Prototype Building Models. Accessed October 2020 from https://www.energycodes.gov/development/commercial/prototype_models.

Appendix-A: The IECC-Based 2023 Florida Energy Code Changes with Energy Impact

Table A-1 summarizes the IECC-based 8th Edition (2023) Commercial Florida Building Code, Energy Conservation changes relative to the 7th Edition (2020) FBCEC. The code modification contains a brief description, identifies whether the change has an energy impact, and whether it is included in the quantitative analysis. This table has six columns, and the headers are defined as follows.

2023 FBCEC Section and Title: This is the code Section and title for the 2023 FBCEC.

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

Change Summary b/t 2020 FBCEC and 2023 FBCEC: This briefly describes the code change between the 2020 FBCEC and 2023 FBCEC.

Anticipated Energy Impact on FBCEC: Anticipated energy use impact from the code change. This is usually a decrease in energy use, an increase in energy use, or none. "None" means the code change has no or negligible impact on energy use.

Included in quantitative Analysis: If the energy impact can be predicted using whole building simulation programs and DOE reference prototype buildings. This is "Yes" or "No". "Yes" means the energy impact can be predicted using a building energy simulation program. "No" means building an energy simulation program cannot determine the effect on energy use.

Discussion: This briefly describes how the change impacted the quantitative analysis, which prototype buildings were affected, or why the code change was excluded.

Table A-1: Commercial Code Change Summary Between 7th Edition (2020) FBCEC and 8th Edition (2023) FBCEC

2023 FBCEC Section and Title	ICC Code Change No.	Change Summary b/t 2020 FBCEC and 2023 FBCEC	Anticipated Energy Impact on FBCEC	Included in quantitative Analysis	Discussion Summary
Chapter C4: Commercial Energy Efficiency					
C402.1.1 Low-energy buildings and greenhouses	CE56-19	This amendment modifies the title by adding "Greenhouses." Greenhouses are still exempt if they use low energy. This amendment moves exception item #3 to a new subsection, C402.1.1.1.	None	No	There is no prototype building with greenhouse space; hence, it is not included in the quantitative analysis.
C402.1.1.1 Greenhouses		Adds new sub-section C402.1.1.1. Greenhouse structures or areas that are mechanically heated or cooled and comply with exterior opaque envelope assemblies sections C402.2 and C402.4.5, interior partition building thermal envelope assemblies that separate the greenhouse from conditioned space comply with sections C402.2, C402.4.3 and C402.4.5, and fenestration assemblies that comply with Table C402.1.1.1 is exempted from the building envelope requirement of this code. Unconditioned greenhouses are exempted.	Decreases	No	There is no prototype building with greenhouse space; hence, it will not be included in the quantitative analysis.
C402.1.2 Equipment buildings	CE58-19	Reduces the stringency by increasing the separate buildings' floor area maximum limit from 600 to 1200 ft^2 for exemption from the thermal envelope requirement of this code.	Increase	No	There is no prototype building with a separate building block; hence, it will not be included in the quantitative analysis.

2023 FBCEC Section and Title	ICC Code Change No.	Change Summary b/t 2020 FBCEC and 2023 FBCEC	Anticipated Energy Impact on FBCEC	Included in quantitative Analysis	Discussion Summary
Table C402.1.4 Opaque Thermal Envelope Assembly Maximum Requirements, *U*-Factor Method	CE61-19 CE73-19	The roof U-factor of metal buildings is decreased to U-0.035 from U-0.044 for climate zone 1 to make it consistent with the R-value in Table C402.1.3.	Decrease	Yes	Impacts warehouse prototype building only; hence, it is included in the quantitative analysis.
C402.5.1.2 Air barrier compliance	CE96-19 CE97-19 CE97-19	Revises the continuous air barrier testing requirements for opaque building envelope and provides three compliance options by adding buildings' thermal envelope performance testing requirements. Buildings in Group R and Group I occupancies must meet provisions of section C402.5.1.2.1 or C402.5.1.2.2; buildings other than Group R and Group I occupancies must meet either the new thermal envelope performance testing provisions of section C402.5.1.2.3 or meet the requirements of section C402.5.1.2.1 or C402.5.1.2.2. The thermal envelope performance testing requirement has three new exceptions depending on the building's floor area and climate zones. 1. Buildings in Climate Zones 2B, 3B, 3C, and 5C. 2. Buildings larger than 5000 ft^2 floor area in Climate Zones 0B, 1, 2A, 4B, and 4C. 3. Buildings between 5000 and 50,000 ft^2 floor area in Climate Zones 0A, 3A and 5B.	Decrease	No	For FBCEC, buildings with occupancy other than group R and group I and larger than 5000 ft2 of floor area are exempt from envelope air leakage testing requirements. This change is an air leakage measurement requirement option. It does not impact any prototype building models, so it is not included in the quantitative analysis.

2023 FBCEC Section and Title	ICC Code Change No.	Change Summary b/t 2020 FBCEC and 2023 FBCEC	Anticipated Energy Impact on FBCEC	Included in quantitative Analysis	Discussion Summary
C402.5.1.2.3 Building thermal envelope testing		Adds new sub-section C402.5.1.2.3. The building thermal envelope must be tested per ASTM E779, ANSI/RESNET/ICC 380, ASTM E1827, or an equivalent method approved by the code official. The measured air leakage must not exceed 0.40 cfm/ft^2 at a pressure differential of 0.3-inch water gauge (75 Pa). Where the measured air leakage rate is > 0.4 cfm/ft^2 and < 0.6 cfm/ft^2, a diagnostic test is conducted using a smoke tracer or infrared imaging, leaks are sealed, and an additional report identifying the corrective actions taken to seal leaks is submitted to code official and the building owner is considered to comply this section.	Decrease	No	This is an air leakage measurement performance testing requirement. There is no impact on any prototype buildings; hence, it is not included in the quantitative analysis.
C402.5.11 Operable openings interlocking	CE106-19	Adds new mandatory section C402.5.11. For occupants utilizing operable openings towards the outdoors that are larger than 40 square feet in area, such openings must be interlocked with the heating and cooling system to raise the cooling set-point to 90°F and lower the heating set-point to 55°F within 10 minutes of opening the operable opening.	Decrease	Yes	The thermostat cooling and heating set points were reset for 10 minutes using the EMS program based on the detected infiltration rate due to the door opening. Impacts hotel and apartment prototype buildings.

2023 FBCEC Section and Title	ICC Code Change No.	Change Summary b/t 2020 FBCEC and 2023 FBCEC	Anticipated Energy Impact on FBCEC	Included in quantitative Analysis	Discussion Summary
C403.3.2 HVAC equipment performance requirements	CE113-19	Revised this section's code language and footnotes for clarity and updated the efficiency values in Tables C403.2.3(1) through C403.2.3(8) per the federal minimum efficiency requirements. Reorganized, substantially revised Tables C403.2.3(9) and C403.2.3(11), and updates minimum efficiency. Adds minimum efficiency requirement for new HVAC equipment in tables C403.2.3(12) through C403.2.3(17). Introduces new efficiency metrics SEER2 and HSPF2 for unitary air conditioners and heat pumps with a capacity less than 65kBtu/h effective as of 01/01/2023.	Decreases in most equipment	Yes	Some of the 2020 FBCEC equipment efficiency tables are equivalent; some already have higher efficiency requirements, and some have lower efficiency requirements. The update added six new tables, including indoor pool dehumidifiers, DOAS units without energy recovery, DOAS units with energy recovery, water source HPs, HP and heat reclaim chiller packages, and ceiling-mounted CRACs. Efficiency upgrades impact all sixteen prototype buildings in climate zones 1A and 2A; hence, they are included in the quantitative analysis.

2023 FBCEC Section and Title	ICC Code Change No.	Change Summary b/t 2020 FBCEC and 2023 FBCEC	Anticipated Energy Impact on FBCEC	Included in quantitative Analysis	Discussion Summary
C403.4.4.5 Supply-air temperature reset controls	CE125-19	Adds clarifications on how the supply air temperature (SAT) reset is applied. The change allows controls that adjust the reset based on zone humidity in Climate Zones 0B, 1B, 2B, 3B, 3C, and 4 through 8. Revises existing exemptions: Systems in Climate Zones 0A, 1A, and 3A have less than 3000 cfm of design outside air. Adds two new exemptions: (1) Systems in Climate Zone 2A with less than 10,000 cfm of design outside air. (2) Systems in Climate Zones 0A, 1A, 2A, and 3A with not less than 80% outside air and employing exhaust air *energy* recovery complying with Section C403.2.7.	Decrease	Yes	This code revision provides design flexibility in Florida's climate zones. SAT reset may not be required for some prototype buildings because a change in the design airflow threshold sometimes decreases the stringency. The supply air temperature reset impacts six prototype buildings: a large Office, primary school, secondary school, outpatient healthcare facility, *hospital, and a large hotel* in Climate Zone 1A only.
C403.4.4.5.1 Dehumidification control interaction		It adds a new sub-section, C403.6.5.1, which says that in climate zones 0A, 1A, 2A, and 3A, the system design must allow supply-air temperature reset while dehumidification is provided. When dehumidification is active, the air economizer must be locked out.	Decreases	No	The change may sometimes increase energy use for some system designs. This change may impact the large office, hotel, and hospital prototype building models.

2023 FBCEC Section and Title	ICC Code Change No.	Change Summary b/t 2020 FBCEC and 2023 FBCEC	Anticipated Energy Impact on FBCEC	Included in quantitative Analysis	Discussion Summary
C403.2.4.8.1 Temperature setpoint controls	CE135-19	Unrented and unoccupied guest room mode must be initiated within 16 hours of the guest room being continuously occupied or when a networked guestroom control system indicates that the guestroom has been unrented and unoccupied for more than 20 minutes. Modifies the code provision that guestroom HVAC controls must be capable of and configured with three modes of temperature control: (1) When the guest room is rented but unoccupied, the controls must automatically raise the cooling set-point and lower the heating set-point by ≥ 4°F (2°C) within 30 minutes after the occupants have left the guest room. (2) When the guest room is unrented and unoccupied, the controls must automatically raise the cooling set point to ≥ 80°F (27°C) and lower the heating set point to ≤ 60°F (16°C). (3) When the guest room is occupied, HVAC set points must return to their occupied set points once occupancy is sensed.	Decrease	Yes	Reduced the cut-off or reset time from 30 to 20 minutes. The change impacts large and small hotel prototype buildings, which is included in the quantitative analysis.
C403.2.4.8.2 Ventilation controls	CE135-19	To ensure consistency between HVAC and lighting control in Section C405.2.1.1, the time-out period for unoccupied guestroom indication was reduced from 30 to 20 minutes.	Decrease	Yes	It impacts large and small hotel prototype buildings. Hence, it is included in the quantitative analysis.

2023 FBCEC Section and Title	ICC Code Change No.	Change Summary b/t 2020 FBCEC and 2023 FBCEC	Anticipated Energy Impact on FBCEC	Included in quantitative Analysis	Discussion Summary
C403.2.6.2 Enclosed parking garage ventilation controls	CE129-19	Replaces “contaminant sensing devices” with “carbon monoxide and nitrogen dioxide detectors.” Reduces the exhaust fan flow threshold for the enclosed parking garage to 8000 cfm from 22,500 cfm and requires using occupant sensors to activate the total rate of ventilation needed.	Decrease	No	There is no prototype building with an enclosed parking garage. Hence, the change is not included in the quantitative analysis.
C403.2.12.7 Low-capacity ventilation fans	CE140-19	Adds new section C403.2.12.7 Low-capacity ventilation fans. This new code provision requires that mechanical ventilation system fans with motors less than 1/12 horsepower in capacity must meet the efficacy of Table C403.2.12.7. This provision is exempted where ventilation fans are a component of a listed heating or cooling appliance or part of a dryer exhaust duct power ventilators, domestic range hoods, and domestic range booster fans that operate intermittently. Adds new Table C403.2.12.7. Minimum efficiency requirements for low-capacity ventilation fans.	Decrease	Yes	Impacts in Outpatient Health Care prototype buildings only. The total efficiency of several low-capacity zone exhausts meeting the criteria was updated.

2023 FBCEC Section and Title	ICC Code Change No.	Change Summary b/t 2020 FBCEC and 2023 FBCEC	Anticipated Energy Impact on FBCEC	Included in quantitative Analysis	Discussion Summary
C403.4.2.3.3 Two-position valve	CE122-19	Revised the section that each hydronic heat pump on the hydronic system having a total pump system power exceeding 10 hp (7.5 kW) must have a two-position "*automatic*" valve, and the value must be "*interlocked with the compressor to shut off the water flow when the compressor is off*."	Decrease	No	This code change clarifies. It does not impact the prototype buildings, so it is not included in the quantitative analysis.
C403.4.2.4 Part-load controls		Reducing the heated or chilled water design output capacity threshold to 300 kBtu/h from 500 kBtu/h increases the stringency of the hydronic systems control requirement. Reduces the minimum combined motor capacity to 2 hp from 10 hp with three or more control valves or other devices for automatically varying fluid flow by at least 50% for hydronic systems. Also, it reduces the minimum combined motor capacity to 2 hp from 10 hp for automatically varying pump flow by at least 50% on heating-water systems, chilled-water systems, and heat rejection loops serving water-cooled unitary air conditioners.	Decrease	No	Chilled and hot water plant loop pumps already use variable-speed drives. Therefore, the prototype buildings impacted by this change need not be updated.

2023 FBCEC Section and Title	ICC Code Change No.	Change Summary b/t 2020 FBCEC and 2023 FBCEC	Anticipated Energy Impact on FBCEC	Included in quantitative Analysis	Discussion Summary
C404.2.1 High input service water-heating systems	CE156-19	This increases the minimum efficiency requirement for service hot water systems to 92% from 90% for a single piece of water-heating equipment that serves the entire building and has a rated capacity of 1.0 MBtu/h or larger. The minimum efficiency requirement for multiple-service hot water equipment does not change.	Decrease	No	This requirement is not a typical design. None of the prototype buildings have this large capacity; hence, it is not included in the quantitative analysis.
C405.2.1.1 Occupant sensor control function	CE167-19 CE169-19	Adds a code provision that occupant sensor controls in *corridor* spaces must comply with a new section C405.2.1.4. Modified an exception that full automatic-on controls with no manual control are allowed in *corridors, interior parking areas, stairways, restrooms, locker rooms, lobbies, library stacks*, and areas where the manual operation would endanger occupant safety or security.	Decrease	Yes	It impacts eight prototype buildings: a Primary School, a Secondary School, outpatient health Care, a Hospital, a Small Hotel, a Large Hotel, a Mid-Rise Apartment, and a *High-Rise Apartment*. The occupancy sensor impact on interior lighting control is modeled by adjusting the hourly schedule fraction values of the corridor space lighting.
C405.2.1 Occupant sensor controls	CE169-19	Adds “Corridor” space type to the list of space types where occupant *sensor controls* must be installed to control lights. Adds new exceptions; luminaires requiring specific application controls per section C405.2.5 are exempted from occupancy sensor-based light control.	Decrease	Yes	It is already included in Section C4052.1.1 analysis.

2023 FBCEC Section and Title	ICC Code Change No.	Change Summary b/t 2020 FBCEC and 2023 FBCEC	Anticipated Energy Impact on FBCEC	Included in quantitative Analysis	Discussion Summary
C405.2.1.4 Occupant sensor control function in corridors	CE169-19	Adds new section C405.2.1.4 Occupant sensor controls in corridor spaces must uniformly reduce lighting power to an unoccupied set point not exceeding 50 % of full power within 20 minutes after all occupants have left the space. Exception: Corridor spaces designed with less than 2-foot candles of illumination on the floor at the darkest point with all lights on are exempted.	Decrease	Yes	This is already included in the Section C4052.1.1 analysis. The impact of the occupancy sensor on lighting control is modeled by adjusting the corridor space lighting hourly schedule fraction values.
C405.2.4.1 Daylight-responsive control function	CE170-19	Renumbers section and updates referenced code section due to section renumbering. Adds a new requirement item #6; when occupant sensor controls have reduced the lighting power to an unoccupied set point per sections C405.2.1.2 through C405.2.1.4, daylight responsive controls must continue to adjust electric light levels in response to available daylight, but must be configured not to increase the lighting power above the specified unoccupied set point.	Decrease	No	There is no impact on the prototype buildings.

2023 FBCEC Section and Title	ICC Code Change No.	Change Summary b/t 2020 FBCEC and 2023 FBCEC	Anticipated Energy Impact on FBCEC	Included in quantitative Analysis	Discussion Summary
C405.2.1.3 Occupant sensor control function in open plan office areas	CE171-19	General lighting in each control zone shall be permitted to turn on automatically upon occupancy within the control zone. *General lighting* in other unoccupied zones within the open-plan office space must be allowed to turn on to at most 20 percent of full power or remain unaffected. General lighting in each control zone shall turn off or uniformly reduce lighting power to an unoccupied set point of not more than 20 percent of full power within 20 minutes after all occupants have left the control zone.	None	No	This clarifies the control requirement—no impact on the prototype buildings.
C405.2.4.1 Daylight-responsive control function	CE185-19	*Daylight responsive controls* must dim lights continuously from full light output to 15 percent of full light output or lower in all *space types*. This change expands daylight-responsive controls to all space types. Previously, it was limited to offices, classrooms, laboratories, and library reading rooms. When occupant sensor controls have reduced the lighting power to an unoccupied set point per Sections C405.2.1.2 through C405.2.1.4, daylight-responsive controls must continue to adjust electric light levels in response to available daylight. They must be configured not to increase the lighting power above the specified unoccupied set point.	Decrease	Yes	Impacts thirteen prototype buildings: small office, medium office, large office, standalone retail, strip mall primary school, secondary school, outpatient healthcare, hospital small hotel, large hotel, warehouse, fast food restaurant, and sit-down restaurant.

2023 FBCEC Section and Title	ICC Code Change No.	Change Summary b/t 2020 FBCEC and 2023 FBCEC	Anticipated Energy Impact on FBCEC	Included in quantitative Analysis	Discussion Summary
C405.2.4.2 Sidelit zone	CE192-19	Renumbers the section and updates referenced code sections due to section renumbering. Adds two new requirements: (1) A new provision for sidelit daylight zone area calculation when the fenestration is located in a rooftop monitor by moving it from the toplit zone section. (2) Requires overhang projection factor limits depending on fenestration orientation.	None	No	Secondary sidelit area control is not required in the 2023 FBCEC; hence, it is not included in the quantitative analysis.
C405.2.8 Parking Garage Lighting Control	CE199-19	Adds new Section C405.2.8. Adds multiple control requirements for parking garage lighting: an automatic time-switch reduces lighting by 30% when no activity is detected, lighting power reduction in transition zones at night, and automatic reduction of lighting near perimeter openings and fenestration in response to daylights. Adds three automatic lighting control exemptions at perimeter wall openings in response to daylight.	Decrease	No	There are no prototype buildings with parking garages. It will not be included in the quantitative analysis.
Table C405.3.2(1) Interior Lighting Power Allowances: Building Area Method	CE206-19	This updates the interior lighting power allowances table for the building area method. It reduces the LPD values for all building types except for the automotive facility, exercise center, library, parking garage, and workshop.	Decrease	Yes	Reduces lighting power allowance using the building area method in the three offices and part of the warehouse prototype buildings.

2023 FBCEC Section and Title	ICC Code Change No.	Change Summary b/t 2020 FBCEC and 2023 FBCEC	Anticipated Energy Impact on FBCEC	Included in quantitative Analysis	Discussion Summary
Table C405.3.2(2) Interior Lighting Power Allowances: Space-by-Space Method	CE208-19	This updates the space-by-space method's interior lighting power allowances table and reduces the LPD values for almost all space types.	Decrease	Yes	Reduces lighting power allowance using the space-by-space method. Impacts all prototype buildings except the three office prototype buildings.
C405.9 Lighting for plant growth and maintenance (Mandatory)	CE209-19	Adds “mandatory” new section. This new mandatory section requires that at least 95 % of the permanently installed luminaires used for plant growth and maintenance must have a minimum photon efficiency of 1.6 μmol/J per ANSI/ASABE S640 standards. Adds new reference standard ASABE S640-2017.	Decrease	No	There are no prototype buildings with a plant growth block; hence, it will not be included in the quantitative analysis.
C405.8.2.1 Energy Recovery (Mandatory)	CE213-19	The section “Energy recovery” has been renamed and designated mandatory. The code language now states that escalators must be designed to recover electrical energy when resisting overspeed in the down direction regardless of the load.	Decrease	No	There are no prototype buildings with an escalator; hence, it will not be included in the quantitative analysis.
Appendices: Commercial					
Appendix CC: Electric Vehicle Charging Provisions For New Commercial Construction	CE217-19	Applicable for new Commercial construction where electric vehicle charging provisions are required. The provisions in this appendix are only mandatory if referenced explicitly in the adopted ordinance.	Decrease	No	It is not part of prototype building energy models; hence, it is not included in the quantitative analysis.

2023 FBCEC Section and Title	ICC Code Change No.	Change Summary b/t 2020 FBCEC and 2023 FBCEC	Anticipated Energy Impact on FBCEC	Included in quantitative Analysis	Discussion Summary
Appendix CD: Board of Appeals—Commercial	ADM41-19	A board of appeals must be established within the jurisdiction to hear applications for modification of the requirements of this code per the provisions of Section C109.	None	No	This is an administrative provision; hence, it is not included in the quantitative analysis.
Appendix CE: Zero Code Renewable Energy Standard	CE264-19	This appendix supplements the requirement for renewable energy systems of adequate capacity to achieve zero-net-carbon.	Decrease	No	This change is not part of typical building design; hence, it is not included in the quantitative analysis.

Appendix-B: The ASHRAE 90.1–Based 2023 Florida Energy Code Changes with Energy Impact

Table B-1 summarizes the 2019 ASHRAE 90.1 based 8th Edition (2023) Commercial Florida Building Code, Energy Conservation 2019 changes with respect to ASHRAE Standard 90.1-2016. The code modifications contain a brief description, energy impact, and whether it is included in the quantitative analysis. This table has six columns, and the headers are defined as follows.

Addendum: This is the code change addenda for the ASHRAE Standard 90.1-2019.

Code Sections Affected: This is the ID of the proposed code change defined in the 2016 ASHRAE 90.1 addenda. This code number is used to identify the code change history.

Code Change Summary b/t ASHRAE 90.1-2016 and ASHRAE 90.1-2019: A brief description of the code change between the 2016 ASHRAE Standard 90.1 and the 2019 ASHRAE Standard 90.1.

Anticipated Energy Impact on FBCEC if Adopted: Energy use impact from the code change. This is usually a decrease in energy use, an increase in energy use, or none. None means the code change has no or negligible impact on energy use.

Included in quantitative Analysis: If the energy impact can be predicted using whole building simulation programs and DOE reference prototype buildings. This is "Yes" or "No". "Yes" means the energy impact can be analyzed using a building energy simulation program. "No" means a simulation program cannot determine the effect on energy use.

Discussion: This briefly describes how the change impacts the implementation in the quantitative analysis, which prototype buildings were impacted, or why the quantitative analysis is included.

The 8th Edition (2023) FBCEC excludes Section 8.4.2 Automatic Receptacle Control, Section 8.4.3 of Electrical Energy Monitoring, and Section 9.4.1.1(g) Interior Lighting Automatic Partial-Off of the 2019 ASHRAE Standard 90.1. These three sections were marked gray in the code change listing summarized in Table B-1.

Table B-1: Commercial Code Change Summary Between ASHRAE 90.1-2016 and ASHRAE 90.1-2019

Addendum	Code Sections Affected	Code Change Summary b/t ASHRAE 90.1-2016 and ASHRAE 90.1-2019	Anticipated Energy Impact on FBCEC if Adopted*	Included in quantitative Analysis	Discussion
3. Definitions, Abbreviations, and Acronyms					
4. Administration and Enforcement					
aw	3.2; Tables 5.5-0 through 5.5-8, 5.8.2.5, 12	Revises the fenestration prescriptive criteria in Tables 5.5-0 through 5.5-8. Fenestration classification is now material neutral and instead grouped into *fixed*, *operable*, and *entrance door* categories. The SHGC is slightly stringent across all types due to glass quality improvement. The U-factor stringency depends on the fenestration framing material. It is more stringent for metal framing products and less stringent for wood framing fenestration.	Decrease	Yes	Improves thermal performance of most fenestration products. Impacts all prototype buildings.
6. Heating, Ventilating, and Air Conditioning					
a	6.4.3.3.3, 6.3.3.4.2, 6.5.1.1.4	Changes term “ventilation air” to “outdoor air” in multiple locations. Revises tables and footnotes. Clarifies requirements for economizer return dampers. Changes term "ventilation air" to "outdoor air" in multiple locations. Adds an exception to allow systems intended to operate continuously, not to install motorized outdoor air damper. Changes return air dampers to require low leakage ratings.	Decrease	Yes	It reduces fan energy by allowing systems intended to operate continuously; not installing motorized outdoor air dampers (less pressure drop) reduces cooling energy for systems with air economizers because of lower leakage through return air dampers.

g	3.2, 6.3.2, 6.5.3.8	Defines “occupied-standby mode” and adds new ventilation air requirements for zones served in *occupied-standby mode*. Adds new definition. Unoccupied space doesn’t need to be ventilated per standard 62.1 when room air temperature is within the allowed limits. This change reduces ventilation air requirements to zero and setsbacks cooling and heating thermostats by at least 1°F for zones served in *occupied standby mode*. Also, this change ties the HVAC control to the lighting control requirement in section 9.4.1.1.	Decrease	Yes	Impacts high apartments, medium-rise apartments, offices, outpatient healthcare, and school prototype buildings.
h	6.5.6.1, 6.5.6.1.1	Exhaust air energy recovery systems should be sized to meet heating and cooling design conditions unless one mode is not required for the climate zone by existing exceptions.	Decrease	Yes	Impacts prototype buildings with ERVs.
j	6.4.3.8	Revises the exception to demand control ventilation (DCV) requirements to clarify that the exception only applies to systems with ERV required to meet Section 6.5.6.1. It reduces HVAC energy by preventing the bad design practice of using ERVs rather than DCVs in climate zones where ERVs are not required, and DCVs save more energy.	Decrease	No	It is not a typical design; hence, it is excluded from quantitative analysis.
k	3.2, 6.4.3.3.5	Revises the “networked guest room control system” definition and aligns HVAC and lighting timeout periods for guest rooms. Reduces the HVAC timeout period from 30 to 20 minutes to match the 20-minute timeout period for lighting control.	Decrease	Yes	Impacts prototype buildings, small and large hotels.

v	6.5.6.3	Adds section 6.5.6.3 containing heat recovery requirements for space conditioning in acute inpatient hospitals. Adds new sub-section. Heat recovery chillers are required in acute inpatient hospitals where the building operates 24 hours, the chilled water system rated capacity is greater than 300 tons, uses simultaneous heats and cools above 60°F, and the heat recovery chiller cooling capacity is greater than 7% of chilled water system rated design capacity. This section has exceptions depending on on-site recovered or generated energy and climate zones.	Decrease	Yes	It is included in the quantitative analysis. The change impacts hospital prototype building.
ai	3.2, 4.2.5, 5.2.9, 6.7.2.4, 9.4.3, 5.9 through 10.9, 11.2	Reorganize commissioning and functional testing requirements in all sections of Standard 90.1 to require verification for smaller and simpler buildings and commissioning for larger and more complex buildings. This change is a clarification.	Decrease	No	It was excluded from the quantitative analysis because it cannot be modeled.
am	6.5.6.4	New section 6.5.6.4 adds an indoor pool dehumidifier energy recovery requirement. It requires 50% energy recovery efficiency.	Decrease	No	It is excluded from the quantitative analysis because the prototype buildings do not have an indoor pool.
ao	3.2; 6.5.3.1.3;	This section introduces the revised fan product efficiency requirement, the Fan Energy Index (FEI), and complements the fan power limitation in section 6.5.3.1.1. FEI is DOE's new fan efficiency metric that better represents fan energy use performance.	Decrease	No	It does not apply to the model input.

ap	6.5.3.5	Revises supply air temperature reset controls. Applies supply air temperature reset strategy. This code change will bring up to a 5°F supply temperature difference reduction depending on outdoor air temperature or load. This code requirement has exemptions depending on climate zone and design outdoor air flow rate.	Decrease	Yes	Impacts large offices, large hotels, hospitals, outpatient healthcare, and schools prototype buildings.
au	6.5.2.1	Eliminates the requirement that zones with DDC have air flow rates that are no more than 20% of the zone design peak flow rate. Zone reheated air flow rate can be a ventilation requirement per ASHRAE Standard 62.1 instead of 20% of the peak flow rate.	Decrease	Yes	Impacts prototype buildings: Medium Office, large office, Primary School, Secondary School, OutPatient Health Care, and large hotel.
ay	3.2, 6.5.6	Provides separate requirements for nontransient dwelling unit exhaust air energy recovery. New section 6.5.6.1.1 Nontransient Dwelling Units. Requires exhaust energy recovery at least 50% efficiency for cooling and 60% for heating for non-transient dwelling units (apartments and condos four-story and higher).	Decrease	Yes	Impacts the non-transient Dwelling Units in High and Medium Rise Apartment prototype buildings.
bd	Table 6.8.1-16	Adds the minimum efficiency requirements of Heat Pump and Heat Reclaim Chiller Packages. Adds minimum efficiency requirement for Heat Pump and Heat Reclaim Chiller Packages as a new HVAC equipment category.	Decrease	Yes	Impacts hospital prototype building.
be	6.4.1.1; Table 6.8.1-10, 6.8.1-17	Revises the minimum efficiency requirements for Computer Room air conditioners. Upgrades the minimum efficiency requirement based on federal minimum efficiency.	Decrease	Yes	Requires higher efficiency CRAC—impacts building with computer rooms and air conditioners.

bl	Table 6.8.1-1	Revises Table 6.8.1-1 Electrically Operated Unitary Air Conditioners and Condensing Units—Minimum Efficiency Requirements. Upgrades the minimum efficiency requirement based on federal minimum efficiency.	Decrease	Yes	
bm	Table 6.8.1-2, 6.8.1-15	Revises Table 6.8.1-2 Electrically Operated Air Cooled Unitary Heat Pumps—Minimum Efficiency Requirements. Adds Table 6.8.1-15. Upgrades the minimum efficiency requirement based on federal minimum efficiency.	Decrease	Yes	
bn	3.2, Table 6.8.1-4, Table F3	Revises Table 6.8.1-4 Electrically Operated Packaged Terminal Air Conditioners, Packaged Terminal Heat Pumps, Single-Package Vertical Air Conditioners, Single-Package Vertical Heat Pumps, Room Air Conditioners, and Room Air Conditioner Heat Pumps—Minimum Efficiency Requirements. Adds Table F-3. Upgrades the minimum efficiency requirement based on federal minimum efficiency.	Decrease	Yes	
bo	3; Table 6.8.1-5; Table F-4	Revises Table 6.8.1-5 Warm-Air Furnaces and Combination Warm-Air Furnaces/Air-Conditioning Units, Warm-Air Duct Furnaces, and Unit Heaters—Minimum Efficiency Requirements and adds Table F-4 Residential Warm Air Furnaces – Minimum Efficiency Requirements for sale in the US. (see 10 CFR Part 430). Upgrades the minimum efficiency requirement based on federal minimum efficiency.	Decrease	Yes	Impacts prototype buildings with this equipment depending on the capacity.

bp	Table 6.8.1-6; Table F-5	Table 6.8.1.6 Revises gas and Oil-Fired Boilers – Minimum Efficiency Requirements and adds Table F-5 - Residential Boiler Minimum Efficiency Requirements for applications in the US (Refer to 10 CFR 430). Upgrades the minimum efficiency requirement based on federal minimum efficiency.	Decrease	Yes	Impacts prototype buildings with boilers.
bq	Table 6.8.1-7; 12	Revises Table 6.8.1-7 Performance Requirements for Heat Rejection Equipment—Minimum Efficiency Requirements. Upgrades the minimum efficiency requirement of some heat rejection equipment categories based on federal minimum efficiency.	Decrease	Yes	Requires higher efficiency dry cooler.
br	Table 6.8.1-11	Revises the previous Tables 6.8.1-12 & 13 and combines them into Table 6.8.1-11 Commercial Refrigerators, Commercial Freezers and Refrigeration—Minimum Efficiency Requirements. Updates the efficiencies levels.	Decrease	No	They were excluded from the quantitative analysis because they are federally regulated.
cm	6.5.2.1	Revises exceptions related to DDC-enabled zones. Removes exception 2(a), which exempts when the minimum supply air flow rate is less than 25% of the peak design flow rate. This code change makes the section consistent with the addenda “ao”.	Decrease	Yes	Similar to Addendum au. Impacts prototype buildings: medium office, large office, primary school, secondary school, outpatient health care, and large hotel.

cn	6.4, 6.4.1.1, 6.4.5m Tables 6.8.1-18,19, & 20.	Cleans up outdated language regarding walk-in cooler and walk-in freezer requirements, and make the requirements consistent with current federal regulations that either already came into effect June 5, 2017, or will go into effect July 10, 2020. Adds new section 6.4.5(m) and Tables 6.8.1-18, -19, and -20. It makes the code consistent with federal minimum requirements.	Decrease	No	This change is a clarification.
7. Service Water Heating					
bs	Table 7.8; F2; Table F-2	Revises Table 7.8 Performance Requirements for Water-Heating Equipment—Minimum Efficiency Requirements and Table F-2 Minimum Energy Efficiency Requirements for Water Heaters.	Decrease	No	They were excluded from the quantitative analysis. The selected equipment efficiency upgrade does not impact prototype buildings.
8. Power					
	8.4.2	The 2023 FBCEC excludes Section 8.4.2 Automatic receptacle control.	Increase	No	This change impacts the prototype buildings: apartments, hospitals, hotels, offices, Outpatient Health Care, Restaurants, Retail Standalone, Schools, and warehouses.
	8.4.3	The 2023 FBCEC excludes Section 8.4.3 of Electrical energy monitoring.	Increase	No	Energy monitoring cannot be included in the quantitative analysis.
9. Lighting					

bg (formerly addendum bg to 90.1-2013)	9.2, 9.3 9.3.1, 9.3.2 Tables 9.3.1-1, 9.3.1-2, 9.3.1-3, and 9.3.2	Adds a new Simplified Building Method Compliance Path for interior lights in offices, schools, retail buildings, and exterior lights. This is a simpler and faster lighting compliance method applicable when at least 80% of the floor area is used for office, school, or retail buildings. The method is used in new construction, additions, or alterations with a floor area of less than 25,000 ft^2. Interior and exterior wattage allowances shall be calculated and complied with separately. All interior lights are counted. The LPD is lower than that of the space-by-space method.	Decrease	No	It provides flexibility for designers but will not impact the prototype buildings. Excluded from quantitative analysis because the exceptions are not used by typical designs as represented by the prototypes.
t	9.4.2, Table 9.4.2-2	It expands the exterior LPD application table to cover additional exterior spaces currently not covered in the exterior LPD table. This change can cover non-typical exterior lighting area applications not listed in Table 9.4.2. Interior LPDs from Table 9.4.1 are reduced and applied to exterior lighting applications not listed in Table 9.4.2.	Decrease	No	It is excluded from the quantitative analysis. Prototype buildings do not have non-typical exterior lighting applications.
aq	9.1.1, 9.2.2.3, 9.4.1.1, 9.4.1.3, 9.4.4, 9.6.2	Clarifies lighting control requirements for applications not covered in Section 9.6.2, the space-by-space method. This section clarifies the lighting control requirements for lighting (special) applications not explicitly covered in Table 9.6.1 and aligns them to the mandatory control provisions in 9.4.1.	None	No	This is clarification. Needs prototype building models specification check.

bb	Table 9.6.1	Revises the lighting power densities for the Space-by-Space method. The space-by-space method LPDs, on average, were reduced from the 2016 version. Lobby/Hotel reduced from 1.06 to 0.51, Guestroom decreased from 0.77 to 0.41, Classroom reduced from 0.92 to 0.71, and Interior Parking Area increased from 0.14 to 0.15.	Decrease	Yes	It is included in the quantitative analysis depending on the prototype buildings. Impacts all prototype buildings except the three office buildings.
cg	Table 9.5.1	Revises Table 9.5.1 Lighting Power Density Allowances Using the Building Area Method. The building area method LPDs were reduced from the 2016 version. Offices were reduced from 0.79 to 0.64; hotels/motels were reduced from 0.75 to 0.56; retail from 1.06 to 0.84; and warehouses from 0.48 to 0.45.	Decrease	Yes	It is included in the quantitative analysis depending on the prototype buildings. It impacts the three office and warehouse prototype buildings.
cv	9.4.1.2	Updates lighting control requirements for parking garages in section 9.4.1.2. Increases the stringency of lighting control in parking garages: • Reduces lighting power input from 30% to 50% when no activity • Reduces the timeout period from 20 to 10 minutes Continuous daylight dimming down to 50% for luminaires within 20ft of the wall opening.	Decrease	No	It is excluded from quantitative analysis because the prototype buildings do not have parking garages.
cw	9.4.1.1(e), 9.4.1.1(f)	Revises the daylight responsiveness requirements to continuous dimming for sidelight and toplit daylighting controls by (1) eliminating step dimming, (2) using continuous dimming limit set to 20% or less or off, and (3) controlling daylights to unoccupied setpoint when needed.	Decrease	Yes	It impacts prototype buildings with daylighting control, such as small, medium, and large offices, schools, etc.

dn	6.5.6	Modifies exceptions to exhaust air energy recovery requirements.	Decrease	No	Not part of prototype buildings.
	9.4.1.1(g)	The 2023 FBCEC excludes Section 9.4.1.1(g) Automatic partial OFF. The *general lighting* power in the *space* must be *automatically* reduced by at least 50% within 20 minutes of all occupants leaving the *space*.	Increase	No	Automatic Full-Off control will be used in the analysis of the 2023 FBCEC. This change impacts some space types in ten prototype buildings: Large Office, Medium Office, Small Office, Restaurant Fast Food, Restaurant Sit Down, Retail Standalone, Retail Strip Mall, Primary School, Secondary School, and Warehouse.
10. Other Equipment					
an	3.2, 10.4.7**,** Table 10.8-6; 12; Appendix E	This document provides a new table (Table 10.8-6) about the new efficiency requirements for commercial and industrial clean water pumps. It also offers new definitions that are needed to accompany the table. It adds section 10.4.7 and defines the Pump Efficiency Index (PEI).	Decrease	No	It is not a prototype building's model input; hence, it is excluded from the quantitative analysis.
11. Energy Cost Budget Method					

bk	3.2, 11.4.3.2, G2.4.2	Clarifies that such projects must model the same electricity generation system in the baseline and proposed design and align with the interpretation IC 90.1- 2013-16 of ANSI/ASHRAE/IES STANDARD 90.1-2013 from January 21, 2018. If the proposed building has on-site electric generation (e.g., CHP or Fuel Cell), the baseline must include the same generation system but no recovered heat.	Decrease	No	It is excluded from the quantitative analysis because the prototype buildings do not include on-site electric generators.
12. Normative References					
co	12	It adds new normative references and updates existing ones with new effective dates, including several addenda to ASHRAE Standard 62.1-2016, which enables the simplified ventilation procedure. Updates to include references to addendum *f* to 62.1-2016, which enables Simplified Ventilation Procedure to be used for VAV box minimum setpoint controls and system ventilation control.	None	No	It updates references with new effective dates and adds some new references.
Appendix: A through G, and I					
bx	3.2, A6.1, A6.3	Appendix A adds heated slab F-factors for multiple under-slab and perimeter insulation combinations. Adds Table A6.3.1-1 and Table A6.3.1-2.	Decrease	No	Adds new F-factors for slab and perimeter combinations that are not currently covered and do not change existing requirements.

ba	Table G3.1-1 Table G3.1-11	Establishes a methodology for determining the baseline flow rates on projects where service water heating is demonstrated to be reduced by water conservation measures that reduce the physical volume of service water required. Establishes how the baseline is determined when allowed to differ from the proposed design, but the baseline values are unspecified (SWH load, cooking equipment, laboratory equipment, etc.): • Use the prescriptive requirement • Use other applicable standards	Decrease	No	It is not included in the quantitative analysis. This feature may be considered beyond code building design.

Appendix-C: Florida Energy Rates

A representative standard energy rate structure shown in Table C-1 through C-3 was used for energy cost calculation. The three energy rates represent electric demand under 20 kW, between 20 kW and 500 kW, and between 500 kW and 2000 kW, respectively.

Table C-1 Natural Gas Rate and Standard Electricity Rate for Demand under 25kW

Charges Type	Charge Items	Units	Rate
Customer and Demand Charge			
Customer Charge		$/Month	12.68
Demand Charges	Base Demand Charge	$/kW	0.00
	Capacity Payment Charge	$/kW	0.00
	Conservation Charge	$/kW	0.00
Total Demand Charge		$/kW	12.68
Electric Energy Charges			
Non-Fuel Energy Charges	Base Energy Charge		
	Base Energy Charge	cents /kWh	7.180
	Base Energy Charge	cents /kWh	0
	Conservation Charge	cents /kWh	0.125
	Capacity Payment Charge	cents /kWh	0.220
	Environmental Charge	cents /kWh	0.323
Fuel and Additional Charges	GSLM Program		
	Fuel Charge	cents /kWh	0.0
	Levelized Fuel Charge	cents /kWh	3.151
		cents /kWh	0
		cents /kWh	0
		cents /kWh	0
	Storm Charge	cents /kWh	0.346
	Franchise Fee	cents /kWh	0
	Tax clause	cents /kWh	0
Total Energy Rate	Levelized Energy Rate	cents /kWh	11.345
		cents /kWh	
		cents /kWh	
		cents /kWh	
Natural Gas Energy Rates			
Customer Charge		$/Month	31.0
Distribution Charge	GS-1 Range	$/Therm	0.57949
Total Natural Gas Energy Rate		$/Therm	0.57949

Table C-2 Natural Gas Rate and Standard Electricity Rate for Demand 25 kW - 500 kW

Charges Type	**Charge Items**	**Units**	**Rate**
Customer and Demand Charge			
Customer Charge		$/Month	29.98
Demand Charges	Base Demand Charge	$/kW	11.29
	Capacity Payment Charge	$/kW	0.72
	Conservation Charge	$/kW	0.43
	Storm Protection	$/kW	0.70
Total Demand Charge		$/kW	13.14
Electric Energy Charges			
Non-Fuel Energy Charges	Base Energy Charge		
	Base Energy Charge	cents /kWh	2.513
	Base Energy Charge	cents /kWh	2.513
	Conservation Charge	cents /kWh	0
	Capacity Payment Charge	cents /kWh	0
	Environmental Charge	cents /kWh	0.279
Fuel and Additional Charges	GSLM Program		
	Fuel Charge	cents /kWh	0.0
	(Jan-May) Levelized Fuel Charge	cents /kWh	3.151
	(Oct-Dec) Levelized Fuel Charge	cents /kWh	3.151
	Jun-Sep, On-Peak Fuel Charge	cents /kWh	4.476
	Jun-Sep, Off-Peak Fuel Charge	cents /kWh	2.981
	Storm Charge	cents /kWh	0
	Franchise Fee	cents /kWh	0
	Tax clause	cents /kWh	0
Total Energy Rate	Jan-May, Oct-Dec, On-Peak Rate	cents /kWh	3.151
	Jan-May, Oct-Dec, Off-Peak Rate	cents /kWh	3.151
	Jun-Sep, On-Peak Energy Rate	cents /kWh	4.476
	Jun-Sep, Off-Peak Energy Rate	cents /kWh	2.981
Natural Gas Energy Rates			
Customer Charge		$/Month	188.0
Distribution Charge	GS-25K Range	$/Therm	0.44046
Total Natural Gas Energy Rate		$/Therm	0.44046

Table C-3 Natural Gas Rate and Standard Electricity Rate for Demand 500 kW - 2000 kW

Charges Type	**Charge Items**	**Units**	**Rate**
Customer and Demand Charge			
Customer Charge		$/Month	88.00
Demand Charges	Base Demand Charge	$/kW	13.49
	Capacity Payment Charge	$/kW	0.80
	Conservation Charge	$/kW	0.47
	Storm Protection	$/kW	0.73
Total Demand Charge		$/kW	15.49
Electric Energy Charges			
Non-Fuel Energy Charges	Base Energy Charge		
	Base Energy Charge	cents /kWh	1.943
	Base Energy Charge	cents /kWh	1.943
	Conservation Charge	cents /kWh	0
	Capacity Payment Charge	cents /kWh	0
	Environmental Charge	cents /kWh	0.281
Fuel and Additional Charges	GSLM Program		
	Fuel Charge	cents /kWh	0.0
	(Jan-May) Levelized Fuel Charge	cents /kWh	3.147
	(Oct-Dec) Levelized Fuel Charge	cents /kWh	3.147
	Jun-Sep, On-Peak Fuel Charge	cents /kWh	4.471
	Jun-Sep, Off-Peak Fuel Charge	cents /kWh	2.978
	Storm Charge	cents /kWh	0
	Franchise Fee	cents /kWh	0
	Tax clause	cents /kWh	0
Total Energy Rate	Jan-May, Oct-Dec, On-Peak Rate	cents /kWh	5.371
	Jan-May, Oct-Dec, Off-Peak Rate	cents /kWh	5.371
	Jun-Sep, On-Peak Energy Rate	cents /kWh	6.695
	Jun-Sep, Off-Peak Energy Rate	cents /kWh	5.202
Natural Gas Energy Rates			
Customer Charge		$/Month	188.0
Distribution Charge	GS-25K Range	$/Therm	0.44046
Total Natural Gas Energy Rate		$/Therm	0.44046

Appendix-D: Florida Commercial Building Floor Area Distribution

Floor Area Weighting Factors Determination

The conditioned floor area weighting factors used in this study were generated by processing building stock information obtained from a PNNL report by Jarnagin and Bandyopadhyay (2010). The information obtained includes total floor areas by building type for Florida and national average building weighting factors by climate zones. The national average weighting factors by building type and climate zones 1A and 2A obtained from the PNNL report were used to split the Florida building stock total floor area into climate zones 1A and 2A for each prototype building type. Two sets of weighting factors were generated for this investigation: weighting factors for the two Florida climate zones for each prototype building type and the state's average weighting factors by building type and climate zone. The former weighting factors for climate zones 1A and 2A were used to estimate the EUI for each of the sixteen prototype buildings in Florida. The later weighting factors were used to determine an aggregate EUI across the sixteen commercial prototype buildings for the state of Florida. Table D-1 summarizes commercial buildings' total floor area stock distribution by prototype building in Florida.

Table D-1 Commercial Prototype Buildings Floor Area Distribution in Florida

Building Type	Prototype Building	Prototype Building Floor Area, ft^2	Total Building Floor Area, 1000 ft^2	Floor Area Weighting Factors, %
Office	Small Office	5,502	37,889	5.27
	Medium Office	53,628	42,765	5.94
	Large Office	498,588	16,558	2.30
Retail	Stand-Alone Retail	24,692	83,481	11.60
	Strip Mall	22,500	44,652	6.21
Education	Primary School	73,959	30,815	4.28
	Secondary School	210,887	52,709	7.33
HealthCare	Outpatient Health Care	40,946	20,381	2.83
	Hospital	241,501	16,210	2.25
Lodging	Small Hotel	43,202	4,682	0.65
	Large Hotel	122,120	27,389	3.81
Warehouse	Non-Refrigerated Warehouse	52,045	104,327	14.50
Food Service	Full Service Restaurant	2,501	4,003	0.56
	Quick Service Restaurant	5,502	3,296	0.46
Apartment	Mid-Rise Apartment	33,741	41,402	5.75
	High-Rise Apartment	84,360	188,913	26.25
Total		1,515,674	719,472	100.00

Floor Area Weighting Factors by Florida Climate Zones

Figure D-1 shows Florida's weighting factors by climate zones and prototype building type. The weighting factors for each prototype building type sum to 1.0. These weighting factors split the total floor area stock of each prototype building in the state into climate zone 1A and 2A fractions. For instance, for High Rise Apartments, 95.0% of the total floor area in Florida is in climate zone 1A, and the remaining 5.0% is in climate zone 2A.

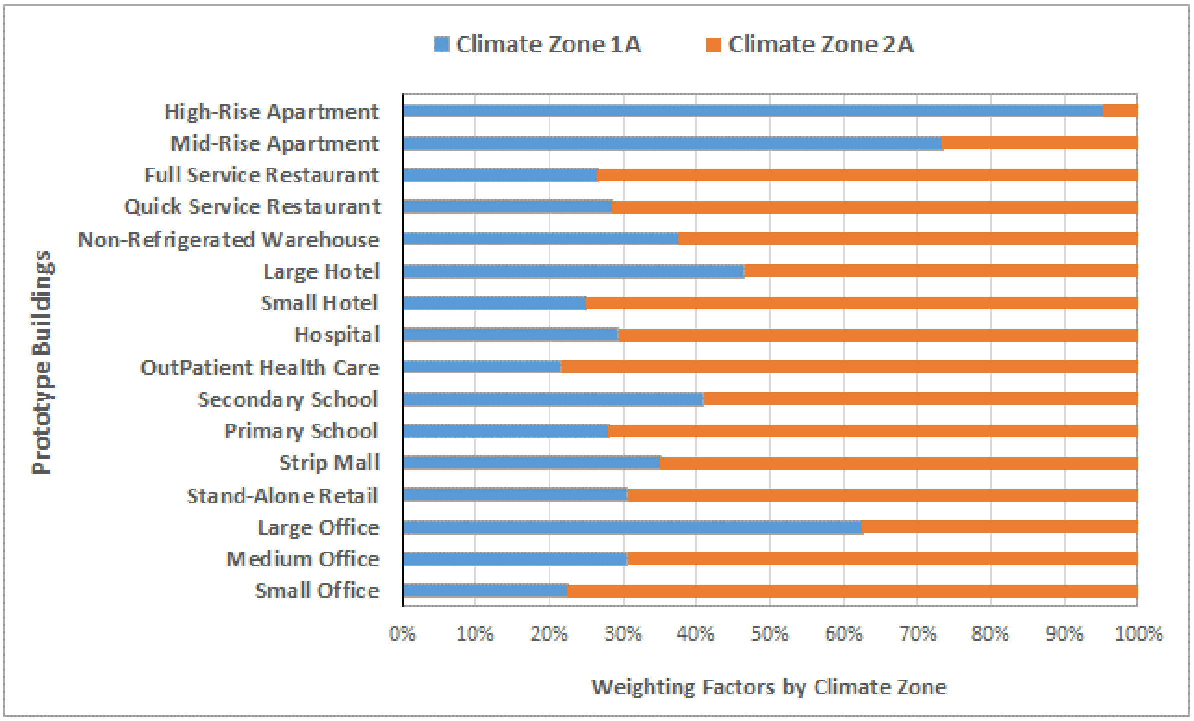

Figure D-1 Florida Floor Area Weighting Factors by Climate Zone and Building Type

Average Floor Area Weighting Factors by Building Type

The average weighting factors were used to determine an aggregate EUI across the sixteen prototype building types for the State. The weighting factors across the sixteen prototype buildings and the two climate zones sum to 1. Figure D-2 shows Florida's average weighting factors by building type (sum of climate zones 1A and 2A). The High Rise Apartment building type represents the highest fraction of total floor area stock in Florida, and it is 26.26% of Florida commercial buildings' entire floor area stock. Warehouse and Standalone Retail commercial prototype buildings are the State's second and third largest by floor area, respectively.

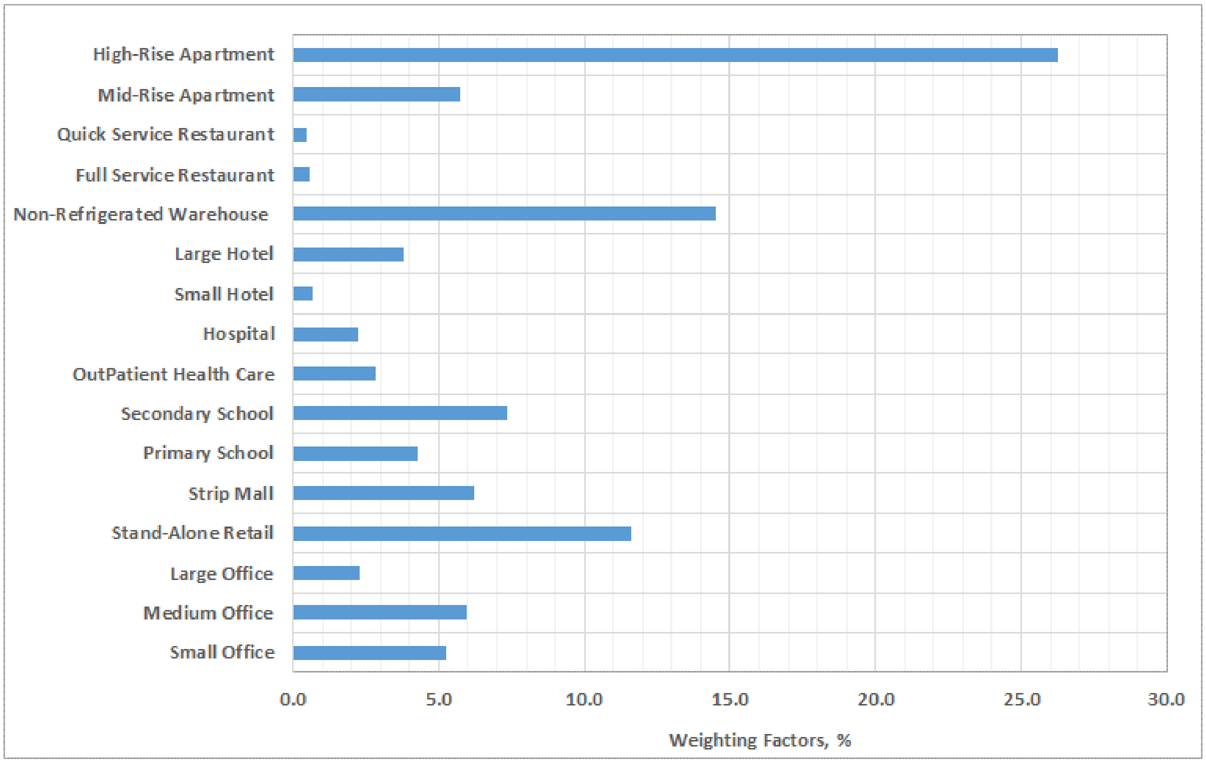

Figure D-2 Commercial Buildings Floor Area Weighting Factors by Prototype Building

The commercial building conditioned floor area distribution for the State of Florida presented here was derived from data published by Jarnagin and Bandyopadhyay (2010). Assumptions were made to split the State's total floor area by climate zones 1A and 2A due to the absence of commercial floor area distribution by state and climate zones. Florida commercial building conditioned floor area distribution by climate zones and building type needs to be determined from recent new building construction records in the State.