DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

DEPARTMENT OF AGRICULTURE

[Docket No. FR–6271–N–03]

RIN 2506–AC55

Final Determination: Adoption of Energy Efficiency Standards for New Construction of HUD- and USDA-Financed Housing

AGENCY: Department of Housing and Urban Development and Department of Agriculture.

ACTION: Notice of final determination.

SUMMARY: The Energy Independence and Security Act of 2007 (EISA) establishes procedures for the U.S. Department of Housing and Urban Development (HUD) and the U.S. Department of Agriculture (USDA) to consider adopting periodic revisions to the International Energy Conservation Code (IECC) and to ANSI/ASHRAE/IES Standard 90.1: Energy Standard for Buildings, Except Low-Rise Residential Buildings (ASHRAE 90.1), subject to a determination by the agencies that the revised codes do not negatively affect the availability or affordability of new construction of single and multifamily housing covered by EISA, and a determination by the Secretary of Energy that the revised codes ''would improve energy efficiency.'' At the time of developing the preliminary determination, the most recent editions of the codes for which DOE had issued efficiency determinations were ASHRAE 90.1–2019, and the 2021 IECC. This notice follows the notice of preliminary determination published on May 18, 2023, and announces the final determination of HUD and USDA as required under section 481(d)(1) of EISA. After consideration of public comments, HUD and USDA determine that the 2021 IECC and ASHRAE 90.1–2019 will not negatively affect the affordability and availability of housing covered by EISA.

DATES:

Effective Date of this Determination: May 28, 2024.

Compliance Date: Compliance is required according to the implementation schedule described in Section VI of this notice; compliance dates vary according to program type.

FOR FURTHER INFORMATION CONTACT:

HUD: Michael Freedberg, Office of Environment and Energy, Department of Housing and Urban Development, 451 7th Street SW, Room 10180, Washington, DC 20410; telephone number 202–402–4366 (this is not a toll-free number). HUD welcomes and is prepared to receive calls from individuals who are deaf or hard of hearing, as well as individuals with speech or communication disabilities. To learn more about how to make an accessible telephone call, please visit: *https://www.fcc.gov/consumers/guides/telecommunications-relay-service-trs.*

USDA: Meghan Walsh, Rural Housing Service, Department of Agriculture, 1400 Independence Avenue SW, Room 6900–S, Washington, DC 20250; telephone number 202–205–9590 (this is not a toll-free number).

SUPPLEMENTARY INFORMATION:

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I. Background

A. Statutory Requirements

Section 481 of the Energy Independence and Security Act of 2007 (''EISA,'' Pub. L. 110–140) amended section 109 of the Cranston-Gonzalez National Affordable Housing Act of 1990 (Cranston-Gonzalez) (42 U.S.C. 12709), which establishes procedures for setting minimum energy standards for the following three categories of housing financed or assisted by HUD and USDA:

- New construction of public and assisted housing and single family and multifamily residential housing (other than manufactured homes) subject to mortgages insured under the National Housing Act; [1]
- New construction of single family housing (other than manufactured homes) subject to mortgages insured, guaranteed, or made by the Secretary of Agriculture under title V of the Housing Act of 1949; [2] and,
- Rehabilitation and new construction of public and assisted housing funded by HOPE VI revitalization grants under section 24 of the United States Housing Act of 1937 (42 U.S.C. 1437v).

In addition to these EISA-specified categories, two HUD programs apply EISA to new construction projects through their program statutes and regulations: the HOME Investment Partnerships Program (HOME) and the Housing Trust Fund. Sections 215(a)(1)(F) and (b)(4) of Cranston-Gonzalez (42 U.S.C. 12745(a)(1)(F) and (b)(4)) make new construction of rental housing and homeownership housing assisted under the HOME program subject to section 109 of Cranston-Gonzalez (42 U.S.C. 12709) and, therefore, to section 481 of EISA. Although the energy standards at 24 CFR 92.251(a)(2)(ii) are reserved in the July 2013 HOME final program rule, the statutory requirements of section 109 of Cranston-Gonzalez (42 U.S.C. 12709) continue to apply to all newly constructed housing funded by the HOME program.

For the Housing Trust Fund, program regulations at 24 CFR 93.301(a)(2)(ii), Property Standards, require compliance with the minimum standards required under Cranston Gonzalez section 109 (42 U.S.C. 12709).

EISA references two standards: the International Energy Conservation Code (IECC) and ANSI/ASHRAE/IES Standard 90.1.[3] The IECC standard applies to single family homes and multifamily low-rise buildings (up to 3 stories), while the ASHRAE 90.1 standard applies to multifamily residential buildings with 4 or more stories.[4] For both agencies, applicability is limited to newly constructed housing and does not include the purchase or repair of existing housing.[5]

Sections 109(c) and (d) of Cranston-Gonzalez, as amended by EISA, establish procedures for updating HUD and USDA energy standards following periodic revisions to the IECC and ASHRAE 90.1 codes, typically every three years. Specifically, section 109(d) of Cranston-Gonzalez (42 U.S.C. 12709) provides that revisions to the IECC or ASHRAE 90.1 codes will apply to the three categories of housing financed or assisted by HUD or USDA described above if: (1) the agencies ''make a determination that the revised codes do not negatively affect the availability or affordability'' of such housing, and (2) the Secretary of Energy has made a determination under section 304 of the Energy Conservation and Production Act (42 U.S.C. 6833) that the revised codes would improve energy efficiency (42 U.S.C. 12709(d)). On July 28, 2021, the Department of Energy (DOE) published final determinations that the 2021 IECC and ASHRAE 90.1–2019 standards would improve energy efficiency (86 FR 40529 and 86 FR 40543).

Through this notice, HUD and USDA issue their final determination that the 2021 IECC and ASHRAE 90.1–2019 energy codes will not negatively impact the affordability or availability of housing covered by EISA.

Note that manufactured housing is not covered in this notice: the relevant

[1] This subsection of EISA refers to HUD programs. See Table 2 for specific HUD programs covered by the Act.

[2] See Table 2 for specific USDA programs covered by the Act.

[3] ANSI—American National Standards Institute; ASHRAE—American Society of Heating, Refrigerating, and Air-Conditioning Engineers; IES—Illuminating Electrical Society.

[4] Note the IECC addresses both residential and commercial buildings. ASHRAE 90.1 covers commercial buildings only, including multifamily buildings four or more stories above grade. IECC Section C 401.2 adopts, by reference, ASHRAE 90.1; *i.e.* compliance with ASHRAE 90.1 qualifies as compliance with the IECC for commercial buildings.

[5] The statute covers rehabilitation as well as new construction of housing assisted by HOPE VI revitalization grants; however, as noted below, the HOPE VI program is no longer funded.

section of the EISA statute specifically excludes manufactured housing; DOE has issued a separate final rule under EISA section 413 that establishes energy conservation standards for manufactured housing (42 U.S.C. 17071).[6] Those standards are also based on the 2021 edition of the IECC adapted for the unique features of manufactured housing, as well as feedback received during interagency consultation with HUD and extensive public comments from stakeholders.

B. Energy Codes Overview

There are two primary benefits of adopting energy-saving building codes: a private benefit for residents—either homeowners or renters—in the form of lower energy costs, and the external social value of reducing the emission of greenhouse gases (GHGs). Additional benefits include improved health and resilience against extreme hot or cold weather events. The affordability analysis contained in this notice focuses exclusively on the first of these benefits: the direct costs and savings to the consumer, both in the short and long term, for both renters and homebuyers. The affordability analysis recognizes the unique nature of the energy efficiency investment: while there is a one-time incremental cost, the benefits in terms of energy and utility cost savings to the consumer persist over time, for as long as the property exists. This is especially important for low- and moderate-income renters and homeowners, who share a disproportionate energy cost burden, spending a significantly higher share of their incomes on energy than other households. The accompanying Regulatory Impact Analysis (RIA) also addresses a second benefit, the external cost savings in the ''social cost of carbon,'' but these are larger societal benefits that may result from lowering energy use in the HUD- and USDA-financed housing and are not directly reflected in the cost of buying, owning, or renting a home, and therefore are not included in the affordability analysis.

As discussed in more detail below, states or localities typically adopt the IECC and ASHRAE 90.1 standards on a voluntary basis one or more years after their publication. As of December 2023, only a small number of states (five) have adopted the 2021 IECC or its equivalent (California, Washington, Connecticut, New Jersey, and Vermont), another five states have adopted the 2021 IECC with weakening amendments (Florida, Louisiana, Montana, Maryland, and Oregon), while another twenty or more states are actively considering and are likely to adopt some version of this code in the near future.

Adoption of ASHRAE 90.1–2019 for multifamily buildings has been more advanced, with ten states and the District of Columbia (DC) having adopted this standard as of December 2023. Another two states (Florida and Louisiana) have adopted the 2019 standards with weakening amendments.

DOE has determined that the 2021 IECC represents an approximately 40 percent improvement in energy efficiency for residential and commercial buildings compared to the 2006 edition and 34.3 percent compared to the 2009 edition.[7] The 2021 IECC also for the first time includes a Zero Energy Appendix. The Appendix is an optional add-on to the 2021 IECC that—if adopted by a state or local jurisdiction—will result in residential buildings having net zero energy consumption over the course of a year.

DOE has also determined that the 2019 edition of ASHRAE 90.1 represents a 2.65 percent efficiency improvement over the 2016 edition, and approximately 33 percent over the 2007 edition. As explained in DOE's State Portal, DOE assesses state energy code adoption based on a quantitative analysis of energy savings impacts within the state.[8] This approach analyzes the energy use of a state base code along with accompanying state amendments through DOE's energy modeling framework to determine an overall ''state energy index.'' The state index is then compared to the index of the last six national model energy codes to characterize each state at a specific code equivalency. The current state adoption of the IECC- and ASHRAE 90.1-equivalent standards is as follows:

Table 1. Distribution of State Adoption of IECC and ASHRAE 90.1 Equivalent Standards

IECC Equivalent Code* Single Family and Low-Rise Multifamily		ASHRAE 90.1 Equivalent Code* Mid-Rise and High-Rise Multifamily	
Code Equivalent Year	**Number of States**	**Code Equivalent Year**	**Number of States**
IECC 2024	0	ASHRAE 90.1 – 2022	0
IECC 2021	5	ASHRAE 90.1 – 2019	10 + DC
IECC 2018	11 + DC	ASHRAE 90.1 – 2016	3
IECC 2015	2	ASHRAE 90.1 – 2013	17
IECC 2012	0	ASHRAE 90.1 – 2010	3
IECC 2009	23	ASHRAE 90.1 – 2007	7
Less stringent than IECC 2009, No Statewide Code or Home Rule	9	Less stringent than ASHRAE 90.1-2007, No Statewide Code or Home Rule	10

*As of December 2023.

[6] 87 FR 32728 (May 31, 2022); 10 CFR part 460.

[7] Lucas R.G., Z.T. Taylor, V.V. Mendon, and S. Goel. 2012. National Energy and Cost Savings for New Single- and Multifamily Homes: A Comparison of the 2006, 2009, and 2012 Editions of the IECC. Richland, WA: Pacific Northwest National Laboratory.

[8] DOE State Portal, *https://www.energycodes.gov/state-portal.*

C. Covered HUD and USDA Programs

Table 2 lists the specific HUD and USDA programs covered by EISA, with certain exclusions noted, as discussed below. Apart from the HOPE VI program, where rehabilitation is referenced, only new construction of housing financed or assisted under these programs is covered by EISA.

Table 2. Covered HUD and USDA Programs (New Construction)

HUD Programs	Legal Authority	Regulations or Notices
Public Housing Capital Fund	Section 9(d) and Section 30 of the U.S. Housing Act of 1937 (42 U.S.C. 1437g(d) and 1437z-2)	24 CFR part 905
Capital Fund Financing Program	Section 9(d) and Section 30 of the U.S. Housing Act of 1937 (42 U.S.C. 1437g(d) and 1437z-2).	24 CFR part 905 subpart E
*HOPE VI Revitalization of Severely Distressed Public Housing	Section 24 of the U.S. Housing Act of 1937 (42 U.S.C. 1437v)	FR-5415-N-07
Choice Neighborhoods Implementation Grants	Section 24 of the U.S. Housing Act of 1937 (42 U.S.C. 1437v)	Implementation Grants notice of Funding Opportunity (NOFO)
Project-Based Voucher Program	Section 8 of the U.S. Housing Act of 1937 (42 U.S.C. 1437f)	24 CFR part 983
Section 202 Supportive Housing for the Elderly	Section 202 of the Housing Act of 1959 (12 U.S.C. 1701q), as amended.	24 CFR part 891
Section 811 Supportive Housing for Persons with Disabilities	Section 811 of the Cranston-Gonzalez National Affordable Housing Act (42 U.S.C. 8013) as amended.	24 CFR part 891
Rental Assistance Demonstration (RAD)	Consolidated and Further Continuing Appropriations Act of 2012 (Public Law 112-55), as amended by Consolidated Appropriations Act, 2014 (Public Law 113-76) and subsequent HUD	RAD notice Revision 4 (H 2019-09 PIH 2019-23)

HUD Programs	Legal Authority	Regulations or Notices
	Appropriations Acts.	
FHA Single Family Mortgage Insurance Programs	National Housing Act, Sections 203(b) (12 U.S.C. 1709(b)), Section 251 (12 U.S.C. 1715z-16), Section 247 (12 U.S.C. 1715z-12), Section 203(h) (12 U.S.C. 1709(h)), Housing and Economic Recovery Act of 2008 (Public Law 110-289), Section 248 of the National Housing Act (12 U.S.C. 1715z-13)	24 CFR part 203, subpart A; 203.18(i); 203.43i; 203.49; 203.43h.
FHA Multifamily Mortgage Insurance Programs	Sections 213, 220, 221, 231, and 232 of the National Housing Act (12 U.S.C.1715e, 12 U.S.C.1715v, 12 U.S.C.1715k, 12 U.S.C.17151, 12 U.S.C.1715w).	24 CFR parts 200, subpart A, 213; 220; 221, subparts C and D; 231; and 232
HOME Investment Partnerships (HOME) [By regulation]	Cranston-Gonzalez sections 215(b)(4) and 215(a)(1)(F) (42 U.S.C. 12745(b)(4) and 42 U.S.C. 12745(a)(1)(F)) require HOME units to meet minimum energy efficiency standards promulgated by the Secretary in accordance with Cranston-Gonzalez section 109 (42 U.S.C. 12745).	Final HOME Rule at www.onecpd.info/home/home-final-rule/ reserves the energy standard for a separate rulemaking at 24 CFR 92.251.
Housing Trust Fund [By regulation]	Title I of the Housing and Economic Recovery Act of 2008, Section 1131 (Public Law 110-289, 12 U.S.C. 4568.)	24 CFR 93.301(a)(2)(ii), Property Standards, requires compliance with Cranston Gonzalez section 109 (42 U.S.C. 12709).
USDA Programs	**Legal Authority**	**Regulations**
Section 502 Guaranteed Housing Loans	Section 502 of Housing Act of 1949 (42 U.S.C. 1472)	7 CFR part 3555
Section 502 Rural Housing Direct Loans	Section 502 of Housing Act of 1949 (42 U.S.C. 1472)	7 CFR part 3550
Section 523 Mutual Self Help Technical Assistance Grants, homeowner participants	Section 523 of Housing Act of 1949 (42 U.S.C. 1472)	7 CFR part 1944 subpart I

* Program no longer funded or no longer funds new construction.

Several exclusions are worth noting, *i.e.,* programs which, while classified as public or assisted housing, or may be specified in the statute, are no longer funded or do not fund new construction:

- HOPE VI. While EISA references the ''rehabilitation and new construction of public and assisted housing funded by HOPE VI revitalization grants,'' funding for HOPE VI revitalization grants was discontinued in fiscal year (FY) 2011; the program is therefore not covered by this notice.
- Project Based Rental Assistance (PBRA). HUD is no longer authorized to provide funding for new construction of units assisted under the Section 8 PBRA program, except under the Rental Assistance Demonstration (RAD). Apart from RAD, current authorization and funding that Congress provides for the PBRA program is for the limited purpose of renewing expiring Section 8 rental-assistance contracts. Accordingly, this notice does not apply to the current Section 8 PBRA program except through RAD, as referenced in Table 2. If in the future Congress were to appropriate funds for new PBRA assisted units, such developments would be covered by this determination.

In addition, other HUD programs that provide financing for new construction are not covered because they do not constitute ''assisted housing'' as specified in EISA and/or are not authorized under statutes specifically referenced in EISA, as follows:

(1) Indian Housing. With the exception of Section 248 FHA-insured mortgages, Indian housing programs are excluded because they do not constitute assisted housing and are not authorized under the National Housing Act (12 U.S.C. 1701 *et seq.*) as specified in EISA. For example, the Section 184 guaranteed loan program is authorized under Section 184 of the Housing and Community Development Act of 1992 (42 U.S.C. 1715z–13a).

(2) Community Development Block Grants. Housing financed with Community Development Block Grant (CDBG) funds is excluded since CDBG, which is authorized by the Housing and

Community Development Act of 1974 (42 U.S.C. 5301 *et seq.*), is neither an assisted housing program nor a National Housing Act mortgage insurance program.

(3) USDA Multifamily Housing and assisted housing financed by USDA Community Facilities loans and grants. These programs are excluded because they are not authorized under the National Housing Act (12 U.S.C. 1701 *et seq.*) as specified by EISA.

D. Current Above-Code Standards or Incentives

Some HUD and USDA competitive grant programs covered by EISA (as well as other programs) already require grantees to comply with energy efficiency standards or green building requirements with energy performance requirements that exceed state or locally adopted IECC and ASHRAE 90.1 standards, while other programs provide incentives to do so. A list of current programs that require or incentivize a green building standard is shown in Table 3. This standard is typically Energy Star Certified New Homes for single family properties, Energy Star for Multifamily New Construction, or a green building standard recognized by HUD that includes a minimum energy efficiency requirement. Nothing in EISA or this notice precludes HUD or USDA competitive programs from requiring these higher standards or raising them further, nor from providing incentives for above-code energy requirements.

Table 3 includes a listing of current HUD and USDA programs with either requirements or incentives for funding recipients to build to standards above the current 2009 IECC and/or ASHRAE 90.1–2007 standards (see ''Exceeds Current Energy Standard'' column). Contingent on the energy standard selected, and the minimum energy efficiency requirements established for each standard, projects built to the energy or green building standards listed in Table 3 may also meet or exceed the 2021 IECC and ASHRAE 90.1–2019 standards discussed in this notice (see ''Meets or Exceeds Proposed Standards'' column). These green building or energy performance standards typically have multiple certification levels with varying energy baseline requirements (gold, green, platinum etc.); these baseline requirements are updated over time at some point after publication of newer editions of the energy codes. HUD and USDA intend to seek certifications from the standard-setting bodies as to which of these programs, or which certification levels, meet the 2021 IECC or ASHRAE 90.1–2019 standards referenced in this notice.

Table 3. Current Energy Standards and Incentives for HUD and USDA Programs (New Construction)[9]

Program	Type of Assistance	Current Energy Efficiency Requirements or Incentives	Exceeds Current Energy Standards	Meets or Exceeds Proposed Standards
Programs Covered by EISA				
HUD				
Choice Neighborhoods Implementation	Competitive Grant	Required: Requirements of ENERGY STAR Single Family New Homes or Multifamily New Construction. Plus certification by recognized green rating such as EPA Indoor airPLUS, Enterprise Green Communities, National Green Building Standard, LEED-H, LEED-NC, or regional standards such as Earthcraft or Built Green. Use ENERGY STAR products.	Exceeds 2009 IECC/ASHRAE 90.1-2007	May meet or exceed 2021 IECC/ ASHRAE 90.1-2019 standard[10]
Choice Neighborhoods – Planning	Competitive Grant	Required: Eligible for Stage 1 Conditional Approval LEED for Neighborhood Development (LEED-ND) or equivalent. Plus certification by recognized green rating program.	Exceeds 2009 IECC/ASHRAE 90.1-2007	May meet or exceed 2021 IECC/ ASHRAE 90.1-2019 standard
Section 202 Supportive Housing for the Elderly	Competitive Grant	Required: 2021 IECC and ASHRAE 90.1-2019. Incentive: Additional competitive rating points for developments that meet a green building or energy performance standard that includes a Zero Energy Ready or Net Zero Energy requirement.	Exceeds 2009 IECC/ASHRAE 90.1-2007	Meets 2021 IECC/ ASHRAE 90.1-2019 standard
Section 811 for Persons with Disabilities	Competitive Grant	Required: 2021 IECC and ASHRAE 90.1-2019. ENERGY STAR Residential New Construction certification.	Exceeds 2009 IECC/ASHRAE 90.1-2007	
Rental Assistance Demonstration (RAD)	Conversion of Existing Units	2009 IECC or ASHRAE 90.1-2007 or any successor code adopted by HUD; applicants encouraged to build to ENERGY STAR Residential New Construction certification. Minimum WaterSense and ENERGY STAR appliances required and the most cost-effective measures identified in the Physical Condition Assessment.		

Program	Type of Assistance	Current Energy Efficiency Requirements or Incentives	Exceeds Current Energy Standards	Meets or Exceeds Proposed Standards
FHA Multifamily Mortgage Insurance	Mortgage Insurance	Incentive: Discounted Mortgage Insurance Premium (Green MIP) for a recognized Green Building Standard. ENERGY STAR Score of at least 75 in EPA Portfolio Manager.	Incentives exceed 2009 IECC/ASHRAE 90.1-2007	May meet or exceed 2021 IECC/ ASHRAE 90.1-2019 standard
FHA Single Family Mortgage Insurance	Mortgage Insurance	2009 IECC		
HOME Investment Partnerships Program	Formula Grant	2009 IECC/ASHRAE 90.1-2007		
Housing Trust Fund	Formula Grant	2009 IECC/ASHRAE 90.1-2007		
Public Housing Capital Fund	Formula Grant	2009 IECC/ASHRAE 90.1-2010 or successor standards. ENERGY STAR appliances also required unless not cost effective.		
Project-Based Vouchers	Rental Assistance	2009 IECC/ASHRAE 90.1-2007		
USDA				
Section 502 Guaranteed Housing Loans	Loan Guarantee	2009 IECC at minimum. Stretch ratio of 2 percent on mortgage qualifications for complying with above-code standards.		
Section 502 Rural Housing Direct Loans	Direct Loan	2009 IECC at minimum. Stretch ratio of 2 percent on mortgage qualifications for complying with above-code standards.		
Section 523 Mutual Self Help	Grant Program	2009 IECC at minimum. State adopted versions of more recent codes vary.		
Programs Not Covered by EISA				
HUD CDBG-DR, CDBG-Mitigation (MIT)	Grants to states or localities	For new construction of substantially damaged buildings, meet a minimum energy standard and green building standard recognized by HUD.	Exceeds 2009 IECC/ASHRAE 90.1-2007 requirements	May meet or exceed 2021 IECC/ ASHRAE 90.1-2019 standard
USDA Multifamily: Sec 515 New Construction, Sec 514/516 Farmworker Housing, Sec 538 Guaranteed Loans; USDA	Direct Loans, Guaranteed Loans and Grants	Meet minimum state or local energy codes; Incentive for Sections 514/515/516: ENERGY STAR Residential New Construction certification, Enterprise Green Communities, NGBS, DOE Zero Energy Ready, LEED, Passive House, Living Building Challenge.	Incentives exceed 2009 IECC/ASHRAE 90.1-2007	May meet or exceed 2021 IECC/ ASHRAE 90.1-2019 standard

Program	Type of Assistance	Current Energy Efficiency Requirements or Incentives	Exceeds Current Energy Standards	Meets or Exceeds Proposed Standards
Community Facilities				

E. Current Housing Market Affordability Trends

HUD and USDA recognize the current affordable housing shortage across the United States, caused by high mortgage interest rates, increased construction costs driven in part by COVID-related supply chain shortages, and an inadequate supply of new housing sufficient to meet demand due to a range of regulatory barriers such as local land use laws and zoning regulations that may limit the production of affordable housing.[11] (Land use regulations that mandate home sizes and volumetric massing are particularly relevant to energy-efficiency because some local zoning policies restrict homes of smaller sizes, which inherently have the potential to be more affordable and better performing homes.) The publication of this notice occurs at a time when housing prices for both new and existing homes have risen significantly over the past three years, increases in mortgage interest rates have reached their highest levels in more than two decades, and it has become increasingly difficult for low-moderate income households to afford a home purchase. The National Association of Realtors' annual survey of homebuyers and home sellers reports that median homebuyer income increased to $107,000 in 2023, an increase of 22 percent from $88,000 in 2022.[12] Median home sales prices increased to $417,700 in the fourth quarter of 2023, a decrease of 14 percent over the prior year but a significant increase since the fourth quarter of 2020, when the median home sales price was $358,700.[13] These trends are mirrored in the FHA-insured market. In 2023, the median price for all FHA-insured purchases, including existing homes, was $290,000, and new construction was approximately $330,000—a nearly $100,000 cost increase in the three-year period since 2020,[14] although still well below the median home sales price for all new homes of $414,600.[15]

The shortage of affordable housing is driven by larger trends in the housing and mortgage markets. In light of these larger trends, it is important to note that a key finding of this notice is that given the relatively modest incremental costs of building to the new standards, the adoption of the proposed codes in this final determination will have a limited impact on overall affordability for low- or moderate-income buyers. Also, energy efficiency is one of the few features of a home that contributes to affordability, in that significant cost savings are projected to be realized from this investment. These savings persist over time. Investments in energy efficiency will also ensure that the next generation of Federally-financed new housing is built to a high-performance standard that realizes lower energy bills, improved comfort, and healthier living conditions for residents. These benefits are long-lasting and will be passed on to future owners.

F. Changes From the Preliminary Determination to the Final Determination

In response to the public comments received, HUD and USDA are adopting several changes in this final determination to incorporate public feedback on the preliminary determination, and address questions and concerns expressed by commenters.

1. Adjusted Economic Factors

In response to several comments about the economic factors used in the affordability analysis, HUD and USDA have updated several economic and cash flow factors to account for changes in the economy as well as the building industry since the original analysis was conducted by Pacific Northwest National Laboratory (PNNL) for DOE using 2020—2021 cost data and economic factors. These revisions address the distortions in the current housing market caused by COVID–19 and global supply chain issues, which significantly increased the cost of construction materials and energy, as well as significant increases in mortgage interest rates during this period.

Construction cost increase. A supply chain cost increase factor has been applied to the incremental cost of adopting the new code to account for the increase in residential construction costs for 2020–23. The 37 percent increase utilizes Bureau of Labor Statistics' Producer Price Index for inputs to residential construction less energy, as reported by the National Association of Home Builders (NAHB).[16]

Energy price increase (2020–22). An energy price increase factor was developed by averaging prices for electricity, natural gas, and heating oil for 2020 through 2022. The three-year averages were used to find the rate of increase of energy prices for each source over this period. These rates were averaged based on the residential energy mix for 2022. Data for calculating the energy price increase factor was sourced from the U.S. Energy Information Administration.[17] [18] [19]

[9] Table 3 includes HUD and USDA programs supporting new construction with energy code requirements. Does not include other HUD or USDA programs that may have appliance or product standards or requirements only, *e.g.,* Energy Star appliances or WaterSense products.

[10] Pursuant to discussion of alternative compliance paths, Section VI, Implementation, some green building standards will meet or exceed the 2021 IECC/ASHRAE 90.1–2019, others may not, HUD and USDA will publish a list of those green building certifications that meet or exceed these codes.

[11] White House Housing Supply Action Plan, President Biden Announces New Actions to Ease the Burden of Housing Costs, May 16, 2022. *www.whitehouse.gov/briefing-room/statements-releases/2022/05/16/president-biden-announces-new-actions-to-ease-the-burden-of-housing-costs/.*

[12] National Assn of Realtors, *2023 Profile of Home Buyers and Sellers,* November 2023. *www.nar.realtor/newsroom/nar-finds-typical-home-buyers-annual-household-income-climbed-to-record-high-of-107000.*

[13] St. Louis Fed, FRED Economic Data, St. Louis Fed, Median Sales Prices of Houses Sold for the United States, Q4 2023. *https://fred.stlouisfed.org/series/MSPUS*

[14] Internal FHA data on median home price for all FHA-insured purchases.

[15] St. Louis Fed, FRED Economic Data, Median Sales Price for New Houses Sold in the United States, October 2023, *https://fred.stlouisfed.org/series/MSPNHSUS.*

[16] David Logen, *Building Materials Prices Fall for Second Month Straight,* June 15, 2023. *https://eyeonhousing.org/2023/06/wbuilding-materials-prices-fall-wfor-second-month-straight/.*

[17] U.S. Energy Information Administration, *Natural Gas Prices. https://www.eia.gov/dnav/ng/ng_pri_sum_a_EPG0_PRS_DMcf_a.htm.*

[18] U.S. Energy Information Administration, *Petroleum & Other Liquids. https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=M_EPD2F_PRS_NUS_DPG&f=M.*

Energy price escalator. A new fuel price escalator of 1.9 percent is based on the estimated 30-year trends in the Energy Information Administration's (EIA) 2023 Annual Energy Outlook. This escalator applies to estimates of future energy price increases, over the baseline established under the Energy Price Increase described above. This escalator was developed from the growth rate for nominal fuel prices (natural gas, heating oil, and electricity) based on the share of energy mix for 2022, which was the most recently available annual data at the time.

Mortgage interest rate. An updated nominal mortgage interest rate of 5.3 percent has been adopted, reflecting approximate two-year Freddie Mac average rates (February 2022–2024).[20] While Freddie Mac interest rates reached a twenty-year high of 7.79 percent for a 30-year fixed rate mortgage, as of November 2023, a moderating trend has begun that is projected to continue, and HUD has accordingly adopted an interest rate that is aligned with the rate currently established by DOE of 5 percent, that reflects the average of the recent 2022–24 two year period rather than rely on a specific rate from a specific point in time that may or may not continue at the same level in the future. In addition, a 6.5 percent example has also been provided (Table 16) to reflect mortgage rates of between 6 and 7 percent forecast for the next year, as well as a 3.5 percent downpayment rate that reflects the minimum FHA downpayment requirement.[21]

Discount rate. A 5.3 percent discount rate (equivalent to a 3 percent discount rate with a 2.24 percent inflation rate) has been adopted to match the mortgage interest rate. The discount rate reflects the time value of money. Following established DOE methodology, the discount rate has been set equal to the mortgage interest rate in nominal terms. The mortgage payment is an investment available to consumers who purchase homes using financing, which makes the mortgage interest rate a reasonable estimate for a consumer's alternative investment rate.

2. Adjusted Cash Flow and Financing Factors

In addition to an updated mortgage interest rate, several adjustments have been made to reflect typical financing factors utilized by FHA and USDA borrowers, as well as likely differences between the house type assumed by PNNL in their original calculations.

Down payment. The down payment contribution for home purchases has been revised to better reflect the typical HUD and USDA borrower. The down payment requirement for FHA borrowers is a minimum of 3.5 percent, distinct from a typical 20 percent down payment requirement for conventional financing without private mortgage insurance (PMI), or the 12 percent down payment rate used by DOE–PNNL and utilized by HUD and USDA in the preliminary determination. The downpayment rate has been updated to 5 percent in the Final Determination.

Mortgage Insurance. The preliminary determination was silent on mortgage insurance requirements, which have now been included in the Final Determination's affordability analysis: FHA's 1.75 percent upfront mortgage insurance premium (MIP) and 0.55 percent annual MIP that took effect in March, 2023.

Adjustment for Home Size. Cost and savings factors have been applied to the affordability analysis to better reflect the typical home FHA or USDA-sized home. These factors revise the analysis to better reflect the smaller home size of a typical FHA or USDA property (2,000 square feet (sf)) compared to a conventionally financed house modeled by PNNL (2,376 sf). While this is a 14 percent ''smaller house'', lower cost and savings factors have been used to approximate the reduced cost and associated savings that are anticipated from the smaller-house size (5 percent and 3 percent respectively).

Note that the revised analysis largely indicates that the proposed standards, while better reflecting the status of the post-COVID housing market conditions, do not change the affordability determination. The relevant tables (Tables 13–20) have been updated with the revised affordability analysis.

3. *Updated State Code Adoption:* Since publishing the preliminary determination, multiple states have adopted new building code requirements, including the codes referenced in this notice, *i.e.* 2021 IECC and ASHRAE 90.1–2019. HUD and USDA have accordingly updated the relevant tables in the Final Determination (Tables 11 and 23) to reflect the new landscape of energy code adoption at the state level, following the latest DOE determinations as of December 2023.

4. *Alternative Compliance Pathways:* HUD and USDA encourage the use of codes and standards that exceed the 2021 IECC and ASHRAE 90.1–2019. HUD and USDA are adding that future versions of the IECC and ASHRAE 90.1 codes, including the 2024 IECC, will be deemed to meet the code requirements of this notice subject to a positive efficiency determination by DOE. Additional information has been added to reflect the compliance paths for certain energy efficiency and green building standards, including EPA's Energy Star for New Construction and DOE's Zero Energy Ready Homes (ZERH) standards.

5. *Implementation and Compliance Timelines.* HUD and USDA have adjusted compliance timetables to better enable the industry to adapt to these code requirements, including an extended compliance period for persistent poverty rural areas where capacity to adopt above-code standards may be challenging.

6. *Inflation Reduction Act (IRA) Tax Credits and Rebates.* This notice addresses the availability of tax credits that are now available for builders to support the cost of building to Energy Star for New Construction and ZERH homes. Both Energy Star (Versions 3.2 single family and 1.2 multifamily) and ZERH specify the 2021 IECC as the minimum standard to qualify for these certifications. In addition, the notice references Home Energy and Appliance Rebates that when implemented by the states will provide an additional source of financing for increasing the energy efficiency of new homes. Note, however, that these tax credits and rebates are not factored into the cost benefit analysis in this determination.

II. Public Comments

HUD and USDA published a notice on May 18, 2023, announcing the preliminary determination that the 2021 IECC and ASHRAE 90.1–2019 do not negatively affect the availability or affordability of houses covered by EISA and seeking public comment (88 FR 31773). The public comment period was extended to, and closed on, August 7, 2023. HUD received and reviewed 120 public comments from a wide range of stakeholders, including one state (Montana); the two code bodies represented in this notice (the International Code Council and ASHRAE); multiple national associations representing mortgage lenders, home builders, environmental and energy efficiency advocates;

[19] U.S. Energy Information Administration, *Electricity Data Browser. Average retail price of Electricity, Annual*

[20] The nominal interest rate used here aligns with a 3 percent real interest rate with a 2.24 percent inflation factor.

[21] Economic, Housing and Mortgage Market Outlook—December 2023—Freddie Mac, *https://ww.freddiemac.com/research/wforecast/20231220-us-economy-wexpanded-in-2023.*

consumers; state energy offices; insulation and other building product trade associations; as well as individuals and other interested parties. The majority of the comments expressed support for HUD and USDA's preliminary determination. Of these supportive comments, most expressed support for HUD and USDA's methodology and conclusions and urged HUD and USDA to rapidly adopt the more recent IECC or ASHRAE 90.1 codes that have been promulgated since the publication of the 2009 IECC and ASHRAE 90.1–2007. In addition, several commenters suggested that HUD and USDA allow alternative compliance pathways for these standards through equivalent or higher state standards or one or more green building standards.

Other commenters highlighted the importance of energy standards in reducing greenhouse gas emissions and increasing the climate resilience of HUD and USDA-supported housing. This will help the country meet national climate goals. Many commenters noted that more efficient homes will reduce stress on the power grid during peak times.

Several commenters suggested that the preliminary determination will help to improve the health and comfort of those living in HUD and USDA-assisted housing in addition to saving on healthcare costs. Many commenters stated that the byproducts of burned methane gas contribute to premature mortality and increase the risk of health complications and respiratory diseases, and that updated energy codes will address health inequities.

In addition to the many supportive comments, several commenters expressed concerns or opposition to one or more features of the preliminary determination. The concerns raised were in four primary areas: the need to update the economic factors used in the preliminary determination to reflect current market conditions, including interest rates, inflation, and energy prices; the first cost estimates used by HUD and PNNL and larger concerns regarding the availability test; an ''appraisal gap'' in valuing the additional cost likely to be incurred when adopting these standards; and the proposed timetable for implementing the standards after a final determination is published.

In the preliminary determination, HUD and USDA sought public comment on all aspects of the determination but were especially interested in responses to eight questions posed in the preliminary determination. This section addresses responses to those questions first, then addresses public comments on additional aspects of the determination.

A. Impact of Higher First Costs Associated With Adopting the 2021 IECC on Availability of Covered Housing to Otherwise-Qualified Buyers or Renters

HUD and USDA requested comments on whether the higher first costs associated with adopting the 2021 IECC over the current 2009 IECC standard for USDA- or HUD-assisted housing, or relative to the most recent 2018 IECC, may lower homebuyer options, despite the significant life-cycle cost savings over the life of the mortgage described in this notice. In other words, whether adoption of the 2021 IECC may limit the availability of such housing to otherwise-qualified buyers or renters.

1. General Support for Preliminary Determination

The large majority of comments supported the findings of the preliminary determination. These comments generally agreed with HUD and USDA's methodology in arriving at the determination that the 2021 IECC and ASHRAE 90.1–2019 would, on balance, not negatively impact the affordability and availability of the housing covered by the determination. For the purpose of this notice, ''affordability'' is assumed to be a measure of consumer demand (whether a home built to the updated energy code is affordable to potential homebuyers or renters), while ''availability'' of housing is a measure of builder supply whether builders will make such housing available to consumers at the higher code level, *i.e.,* whether the higher cost per unit will impact whether that unit is likely to be built or not.

Several commenters agreed with the preliminary determination's finding indicating that the higher first costs associated with adopting the 2021 IECC over the current 2009 IECC would not lower homebuyer options or generally limit the availability of housing to otherwise-qualified buyers or renters. Many commenters agreed with the preliminary determination's analysis that the housing stock in question will remain available. One commenter noted that ''[n]othing in the model codes would prevent builders from building homes that receive federal support. The codes are based on widely available, commercial technologies and provide multiple pathways for complying.'' One commenter cited that these energy codes have already been adopted by many states and therefore will not affect availability. Several commenters emphasized that building housing to the 2021 IECC standard is essential and can be done while maintaining or improving affordability for consumers. Two commenters suggested that reduced energy bills would offset any additional first costs incurred from the new code requirements.

HUD–USDA Response: HUD and USDA appreciate the support expressed by these commenters for the analysis included in the preliminary determination. These comments indicate confidence in HUD's and USDA's use of DOE and PNNL cost-benefit analysis of the subject codes. HUD and USDA conducted thorough affordability and availability analyses to assess the impact of adopting the 2021 IECC, ultimately finding that these codes will not negatively impact the affordability or availability of the covered housing.

2. Cumulative Costs Over 2009 IECC

One commenter noted that the significance of the costs is due to the baseline code being the 2009 IECC instead of the multiple, intermediary energy code updates. One commenter stated that HUD and USDA may overestimate the number of homes that will be impacted by the proposed standards as additional states and cities are likely to adopt either of the codes addressed in this notice in the near future (at which point they will come into compliance with the code requirements).

HUD–USDA Response: The commenter's observation that these costs are higher because they are based on the 2009 edition of the IECC rather than a more recent edition is accurate in that these costs represent the cumulative cost of amendments to several editions of the code since the 2009 edition; the 2012, 2015, and 2018 editions, as well as the current 2021 edition.

Adoption by states of the 2021 IECC is an iterative process: while five states have already adopted a code that meets or exceeds the 2021 IECC, others have adopted an energy code more recent than the 2009 IECC, and a significant number of states are actively considering adoption of the 2021 standard or have already done so with amendments.

Where states have adopted more recent editions (*e.g.,* the 2018 edition), the incremental cost to meet the requirements of the 2021 standard is significantly lower, as shown in Table 19 in the final determination. Note, however, that the cumulative costs represented by the 2009–2021 figures also yield significant cumulative savings: 34 percent in improved energy

efficiency over this period, compared to just 8.3 percent over the most recent 2018 edition.

3. Proposals for Financing and Tax Credits

While generally supportive of the preliminary determination's findings, several commenters recommended measures that HUD and USDA could take to mitigate first cost impacts. Commenters suggested HUD and USDA provide programs and advance policy that allow for reduced downpayments, changes in amortization schedules, changes in underwriting standards, downpayment assistance, tax credits, and other forms of financing assistance. One commenter stated that tax credits and incentives further enable compliance and serve to reduce upfront costs to builders. Commenters also recommended that HUD and USDA identify programs and resources, at the state or federal levels, that will address first cost barriers and make information on accessing these resources available for low-income consumers. One commenter recommended HUD and USDA identify alternative solutions to advance energy efficiency measures that avoid the first cost impacts.

HUD–USDA Response: HUD and USDA appreciate these financing proposals, both with possible HUD–USDA financing incentives, as well as action that HUD–USDA could take to maximize the use of new IRA or BIL tax credits, rebates, or other financing that will become available.

Proposals from commenters for ''reduced downpayments or other forms of flexible financing'' including for example, ''changes in amortization schedules,'' while potentially longer-term options for HUD and USDA consideration, are beyond the scope of this notice. However, regarding comments recommending ''tax credits and other funding mechanisms that could reduce the impact of added first costs,'' there are now significant new resources available through the Inflation Reduction Act (IRA) which provide unprecedented financial support for building energy efficient housing. HUD has already taken, and will continue to take, steps to train and educate builders and developers on how these may be used in conjunction with HUD financing.

The IRA makes available significant tax credits for builders that can potentially offset some of the incremental costs associated with building to the 2021 IECC. Though not considered in the preliminary determination's affordability analysis, energy efficient new homes the section 45L tax credit (45L) encourage builders to consider building and certifying to the Energy Star New Homes (up to $2,500 credit) or DOE's Zero Energy Ready Home (up to $5,000 credit) standards. Energy Star Version 3.2 is estimated to yield additional savings of at least 10 percent over the 2021 IECC, while the ZERH standard is designed to exceed the 2021 IECC by at least 15–20 percent depending on whether multifamily or single family. Note that the 2021 IECC is a minimum baseline requirement for both Energy Star Version 3.2, and DOE's ZERH Version 2 standard, currently in effect. Energy Star Version 3.1 currently qualifies (through December 31, 2024) for the IRA tax credit in those states that have not yet adopted the 2021 IECC.[22]

HUD and USDA recognize that qualifying for these tax credits will require builders to build to a higher overall energy efficiency standard than the 2021 IECC, and that while this will entail additional costs, these costs will be offset—in some cases entirely—when taking advantage of available tax credits. While DOE does not have estimates of the added cost of building to the ZERH standard, EPA provides cost estimates of the incremental costs that would typically be required over the 2021 IECC to build to the new Energy Star Version 3.2 standard. Table 4 provides estimates of these additional costs; the additional cost for building to Energy Star for New Homes ranges from $1,010 in Climate Zone 3 (Memphis) to $1,668 in Climate Zones 6, 7, and 8 (Fairbanks) for all-electric homes; and $1,176 to $2,815 for mixed fuel homes (natural gas + electric). Note that for Energy Star Version 3.2, estimated costs of $1,211—$1,463 in Climate Zones 1–3—where a significant share of housing likely to be impacted by this notice are located—are significantly lower than the $2,500 tax credit, thereby providing builders a significant incentive to build to this standard. These estimates demonstrate that building to Energy Star Version 3.2 in these Climate Zones will in fact lower builder outlays by between $1,000-$1,300 while achieving a higher energy efficiency standard than the 2021 IECC.[23]

Table 4. Incremental Cost of Energy Star Version 3.2 (Above 2021 IECC) in Select Cities

Climate Zone	City	All-Electric	Mixed Fuel
1	Miami	$1,211	$1,377
2	Houston	$1,463	$1,629
3	Memphis	$1,010	$1,176
4	Baltimore	$1,635	$1,935
5	Chicago	$1,920	$2,563
6	Burlington	$1,668	$2,815
7	Duluth	$1,668	$2,815
8	Fairbanks	$1,668	$2,815

[22] Energy Star Version 3.1 is modeled to perform at 10 percent above the 2018 IECC but it does not include a thermal backstop provision required under the 2021 IECC standard.

[23] Cost estimates for Energy Star from U.S. EPA, *National Version 3.2 Costs and Savings, https://www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Version%203.2%20Cost%20%20Savings%20Summary.pdf.*

Both the Energy Star for New Homes and ZERH tax credits are also available for multifamily new construction. A $500 per unit tax credit is available for homes certified to eligible ENERGY STAR Multifamily New Construction (MFNC) program requirements, with a larger tax credit ($2,500 per unit) available when prevailing wage requirements are met.[24] For ZERH homes, the tax credit is $1,000 per dwelling unit, unless the project meets prevailing wage requirements, in which case the 45L tax credit is $5,000 per dwelling unit.[25]

In addition to these tax credits for new construction, the IRA expanded the Section 179(d) commercial building tax credits for multifamily buildings. The new law increased the maximum deduction from $1.88 to $5 per square foot and cannot exceed the cost of the improvement. However, the taxpayer must meet a prevailing wage and apprenticeship requirement.[26]

In addition to the tax credits and deductions available through the IRA, there is another potential source of IRA funds that states may make available for new construction: Home Energy and Appliance Rebates that provide $4.5 billion in rebates for certain energy efficiency and electrification measures such as heat pumps, upgraded electrical service, or solar panels that may be leveraged to lower the first cost of construction for these measures. These funds will be administered by the states and are expected to become available in most states in 2024 or 2025.[27] Home Electrification and Appliance Rebates will also be available to (1) low- or moderate-income households; (2) individuals or entities that own a multifamily building with low- or moderate-income households comprising at least 50 percent of the residents; and (3) governmental, commercial, or nonprofit entities that are carrying out projects for low- or moderate-income households or multifamily building owners.[28] Rebates can be used to offset the cost of the following items: ENERGY STAR-certified electric heat pump water heater; ENERGY STAR-certified electric heat pump for space heating and cooling; ENERGY STAR-certified electric heat pump clothes dryer; ENERGY STAR-certified electric stove, cooktop, range, or oven (note: Energy Star-certified ovens are pending); electric load service center (*i.e.,* electrical panel); electric wiring; insulation, air sealing, and mechanical ventilation. For low-moderate income households, the rebates may be used for as much as 100 percent of the cost of installation.

In addition to these multiple new sources of funding for energy efficiency measures, there are also tax credits and financing sources for the addition of renewables through the IRA. Builders may be able to take advantage of certain EPA Greenhouse Gas Reduction Fund programs, especially the Solar for All initiative. Builders may also be able to utilize the Investment Tax Credit under Section 48 of the Internal Revenue Code focusing on investment in on-site renewable energy production through wind and solar, which has increased incentives for low-income communities, Tribal entities, and specifically for residential buildings.[29]

When using solar energy for housing, creating an energy efficient home is a critical first step towards optimizing energy performance. Energy efficiency in homes has a point at which better energy performance requires the addition of a source of renewable energy. As shown in 2021 IECC Zero Energy Appendix, (Table 5 below), the maximum ERI score of 43–47 for the 2021 IECC, provides a reasonable backstop for energy efficiency and adding renewable energy. Since minimum ERI scores or equivalent HERS ratings are required for Energy Star for Homes, ZERH, and Passive House, to the 2021 IECC provides a sound baseline for home energy efficiency performance before the addition of renewable energy sources to get to net zero energy.

Table 5. Maximum Energy Rating Index – 2021 IECC Appendix RC

Climate Zone	Energy Rating Index	Energy Rating Index
1	43	0
2	45	0
3	47	0
4	47	0
5	47	0
6	46	0
7	46	0
8	46	0

HUD and USDA will work with DOE and states to maximize participation by HUD and USDA stakeholders in these programs. Steps that HUD has already taken to increase use of both the tax credits and rebates now available to support builders wishing to build more energy efficient housing include the new Climate Funding Navigator, which provides a user-friendly portal to all funding opportunities in the IRA and the Bipartisan Infrastructure Law (BIL),

[24] EPA. *https://www.energystar.gov/about/federal-tax-credits/ss-45l-tax-credits-home-builders.*

[25] DOE, 179D Commercial Buildings Energy-Efficiency Tax Deduction Buildings, *https://www.energy.gov/eere/buildings/179d-commercial-buildings-energy-efficiency-tax-deduction.*

[26] A separate $4 billion for HOMES rebates is for existing homes only, and does not cover new construction.

[27] DOE, Home Energy Rebates: Frequently Asked Questions. *https://www.energy.gov/scep/home-energy-rebates-frequently-asked-questions.*

[28] The section 48 investment tax credit offers an up to 30 percentage point credit (if prevailing wage and apprenticeship requirements are met) with an additional 10 percentage point credit for facilities in low-income and Tribal communities and additional 20 percentage point tax credit available for facilities that serve federally-subsidized housing or provide economic benefits to low-income households (information available at *https://www.whitehouse.gov/cleanenergy/clean-energy-updates/2023/08/10/treasury-issues-final-rules-and-procedural-guidance-to-drive-clean-energy-investments-in-low-income-communities-across-the-country/*).

as well as other programs administered by HUD and other Federal agencies.[30]

4. Proposals for Technical Assistance

One commenter recommended protecting homebuyers who may lose eligibility due to the proposed standards by providing technical assistance for state officials, builders, construction workers, and others; addressing differential rural impacts; making adjustments as needed to account for ASHRAE 90.1 standards; and expanding strong energy efficiency requirements to additional assisted housing programs.

HUD–USDA Response: HUD and USDA appreciate the range of comments received that recommended training, technical assistance (TA), and information for builders and developers impacted by this determination. HUD and USDA intend to provide TA to support the implementation of the 2021 IECC and ASHRAE 90.1–2019. The agencies recognize that there may be an ''information gap'' regarding the latest codes in places where prior codes have been adopted by states or local jurisdictions, and that in some locations there may be a learning curve for builders to become familiar with the requirements of the latest editions of the codes. HUD has allocated FY 2022 Community Compass TA funds for this purpose and expects to implement an extensive TA and training effort to ensure that stakeholders are both aware of the new requirements and knowledgeable about the specific updates that are included in the new codes.[31] This may include both webcasts as well as printed and/or online resources that builders, developers, and appraisers can use to familiarize themselves with the new code requirements. Additional on-call TA that responds to builder, consumer, lender, or developer questions may also be available. The specific topics that will be covered have not been identified at this point; however, the agencies will widely circulate any resources or webinars developed in support of the implementation of these new standards. HUD will also work with trade associations to promote these resources to their members, through targeted trainings or at regular association meetings, conferences, or training events. In addition, HUD and USDA will work with DOE and its state and local grantees to leverage $1.2 billion in IRA and BIL energy code TA funds: $330 million to adopt the latest building energy codes, $670 million to adopt building energy codes that meet or exceed the zero energy provisions in the 2021 IECC or other codes and standards with equivalent or greater energy savings, and $225 million to support code adoption and training.

5. Appraisal Gap in Valuing Energy Efficiency Improvements in Home Appraisals

Four commenters raised concerns over challenges with the appraisal process that could impact the ability of FHA and USDA home buyers to afford the added cost of the IECC code. The commenters noted that the analysis included in the preliminary determination assumed construction and production costs would be passed on to homebuyers. Multiple commenters identified the issue of an appraisal gap for energy-efficient homes. The gap arises from the limited ability of the traditional appraisal process to properly account for energy efficiency measures, such as those required by the 2021 IECC, into the valuation of the property. They pointed out that a home may appraise for a value that is less than the cost of materials and labor and that energy efficiency enhancements are often not accounted for in the appraisal. Several commenters stated that this results in development costs exceeding home values, making appraisal practices a major obstacle. One commenter suggested that HUD and USDA establish effective energy-efficient mortgage programs in response.

HUD–USDA Response: The appraisal gap issue discussed by the commenters is larger than just an energy codes issue, as it not only addresses broader issues of how the market values energy efficiency but also how the market values homes generally in underserved markets. HUD and USDA agree that the valuation of energy efficiency in appraisals could act (depending on location) as a market barrier to the adoption of energy-efficient codes. HUD and USDA reviewed these arguments in a section on ''market barriers'' in the Regulatory Impact Analysis (RIA) and provided empirical evidence in a section on capitalization of energy efficiency. From a broader regulatory perspective, there are at least three separate issues that could impact appraisals: (1) cost pass-through rates, which depend on the flexibility of buyers and sellers; (2) imperfect valuation by buyers and sellers due to limited information and thin markets; and (3) the role of experts, including appraisers, in valuing energy-efficient improvements.

- *Pass-through rate:* HUD assumed in much of the analysis that the pass-through rate of costs from builders to buyers was equal to one, *i.e.,* builders pass on the full cost of construction to the buyer. However, another acceptable scenario would have been to assume a pass-through rate less than one, where the buyer will only bear a portion of the costs. HUD mentioned in the RIA that the pass-through rate would vary with the price elasticity of demand and supply.
- *Imperfect information:* HUD explored the possibility that energy efficiency may not be perfectly capitalized in the value of a home. If the value of energy efficiency is not transparent to a prospective buyer, then insufficient capitalization reduces the incentive to build energy-efficient housing. In addition to imperfect information, thin markets (few buyers and sellers) could lead to an undervaluation of less common goods (such as above-average energy efficiency).
- *Role of the appraiser:* A well-informed appraiser is expected to perform valuation services competently and assess the market value of an energy-efficient building relative to other buildings. Increasing education and awareness of energy-efficient improvements for appraisals will contribute to stronger valuations as market and cost data become more available.

HUD and USDA therefore understand that lenders, buyers, and builders of energy efficient housing may be impacted in the short-term, particularly in markets where comparable sales are not yet available, and that intervention can be helpful in certain areas to raise awareness of the value of these improvements. One study finds that approximately 1-in-10 homes are undervalued, while thirty percent are appraised at their sales price.[32]

A study of home appraisals conducted for DOE by the Building Industry Research Alliance identified several barriers to valuing energy efficiency improvements in residential appraisals.[33] These included: (1) lack of comparable sales, surveys of property performance and return expectations in most markets (where limited data is available, appraisers may resort to ''assessing arbitrary values'' for energy efficiency improvements); (2) variations

[30] *https://www.hudexchange.info/programs/build-for-the-future/funding-navigator/.*

[31] *https://www.hud.gov/program_offices/comm_planning/cpdta.*

[32] Calem, Paul, et al, ''Appraising home purchase appraisals.'' Real Estate Economics 49.S1 (2021): 134–168,

[33] Victoria Doyle, Abhay Barghava, *The Role of Appraisals in Energy Efficiency Financing,* Building Industry Research Alliance for the Department of Energy, May 2012.

in occupancy behavior, plug loads and/or weather conditions that could impact the actual energy consumption of a household relative to modeled or estimated energy use; (3) knowledge gaps in the lending and housing industries, both on the part of appraisers and underwriters; (4) lack of energy efficiency appraisal training and education (all states require education, experience and licensing for appraisers but energy efficiency requires a different kind of knowledge, and appraiser licensing does not recognize this specialty as distinct); and (5) ''resistance to change'' by the appraisal industry with the current appraisal methods developed in the 1940s that provide market valuations for aesthetic and structural improvements (the proverbial ''granite countertop'') but do not necessarily recognize energy efficiency as a factor in homeownership cost or property value.

These are inherent limitations in the appraisal industry's current approach to valuing energy efficiency, but there are also important developments that are addressing these barriers. These include the introduction of sustainable building science education and certifications such as the Appraisal Institute's Sustainable Buildings Professional Development Programs that include Introduction to Green Buildings, Case Studies in Appraising Residential Green Buildings, and Case Studies in Appraising Commercial Green Buildings. The National Association of Realtors has expanded its curriculum for the General Accredited Appraiser program to include an introduction to energy-efficient homes, and there is also now a ''Green Designation'' for real estate practitioners including Realtors.

At the same time, to the extent that an appraisal overlooks or does not appropriately value one or more features or improvements of a home, buyers can dispute an appraisal that they feel did not consider all relevant information, so an incentive exists for lenders to engage appraisers who have sufficient competency to appraise energy efficient properties. Sellers in turn have an incentive to provide information that would generate buyer interest in the added improvements.

Information prepared jointly by the Appraisal Institute, the Building Codes Assistance Project, and National Association of Home Builders provides practical solutions, such as how to communicate energy efficiency and where to find qualified appraisers.[34] An appraiser who lacks experience in valuing an energy-efficient building may find that they are passed over for more qualified appraisers with more training. An analysis of energy-efficient buildings in the American Economic Review indicated that the diffusion of energy-efficient technology is enhanced by educating building professionals.[35]

In response to the comments received, HUD reviewed the FHA-insured portfolio from fiscal year 2020 through 2023 to ascertain the extent to which the appraised value of new homes is below, equal to, or above the sales price of the home. One key data point is that, for many FHA borrowers, home appraisal valuations exceed sales prices: 87 percent of 450,000 FHA-insured new home purchases over the past four years had appraisals that exceeded the sales price, and, for 32 percent of new home purchases, appraised values exceeded the sales price by $5,000 or more. The above sales price appraisals indicate that for a significant share of FHA borrowers, even first-time home buyers, there may be a sufficient cushion in the appraisal valuation to allow for some or all of the added cost of an energy-efficient new home, ranging from $2,945 to $7,115 depending on climate zone. While the sales price-home valuation differential shown in Table 6 does not specifically address energy efficiency valuations, the $5,000 or more above-sales price appraised value is important because this buffer is sufficient to cover all or most of the additional cost of the energy improvements, despite any superadequacy or other market failure to recognize the value of the energy improvements.

Table 6. Appraised Values Relative to Sales Price – FHA Insured New Homes 2020-23

	No. of Units				
	FY 2020	**FY 2021**	**FY 2022**	**FY 2023**	**All Yrs**
Appraised Value < Sales Price	2,692	5,614	4,415	2,235	14,956
Appraised Value = Sales Price	13,711	12,341	8,304	9,776	44,132
Appraised Value > Sales Price	102,619	112,669	88,921	87,383	391,592
Total	119,022	130,624	101,640	99,394	450,680
% Appraised Value < or = Sales Price	14%	14%	13%	12%	13%
% Appraised Value > Sales Price	86%	86%	87%	88%	87%
% Appraised Value > $5k above sales Price	21%	27%	42%	41%	32%

Another important development that can support the recognition of energy efficiency in home appraisals has been the growth of regional Multiple Listing Service (MLS) databases that include energy efficiency and other sustainable measures in their listings. The National Association of Realtors (NAR) published its Green MLS Toolkit as an educational resource for homebuyers, homeowners, realtors, and appraisers to use to develop a better understanding of energy-efficient homes.[36]

The importance of this initiative cannot be understated. A key concern from the housing, financing and appraisal industries has been the lack of

[34] Appraisal Institute, New Appraisal Guidance Addresses Green Housing, 2015, *https://nationalmortgageprofessional.com/news/56670/new-appraisal-guidance-addresses-green-housing* See also *https://www.appraisalinstitute.org/education/education-resources/green-resources.*

[35] Kok, Nils, Marquise McGraw, and John M. Quigley. ''The diffusion of energy efficiency in building.'' American Economic Review 101.3 (2011): 77–82.

[36] National Association of Realtors, Green MLS Implementation Guide, https://green.realtor/sites/files/2019-02/2014%20NAR%20Green%20MLS%20Implementation%20Guide.pdf.

data or access to supporting documentation for valuing energy efficiency improvements. A Green MLS mediates this concern, documenting both measures that are visible and apparent, as well as high-impact energy efficiency measures that are less visible, such as wall insulation and/or low-e windows. The development of the Green MLS Toolkit is ''pivotal for the proper valuation of efficiency. . .For appraisers, a Green MLS supports an apples-to-apples comparison for energy efficient features; without a Green MLS, the appraiser may not have sufficient information and data to support an assessment of energy efficiency improvements.'' [37]

Another significant development has been the development of the Residential Energy Efficiency and Green Addendum for use with the Uniform Residential Appraisal Report, one of the most commonly used forms for completing a home appraisal. It provides standardized reporting and analysis for single family home valuations. The 3-page form provides appraisers the opportunity to recognize energy improvements as part of a home evaluation assessment, including appliance efficiency or insulation levels, whether the home achieves an energy efficiency certification such as Energy Star or other green building standards, and other salient characteristics of the home. By enabling appraisers to collect and document the additional information needed to form an Opinion of Value on a high-performance home, appraisers will be better equipped to identify recent comparable sales. If the home has a HERS rating, RESNET or other third-party energy raters can verify and pre-populate the Addendum for the appraiser. This removes the responsibility of the appraiser to attempt to provide an energy assessment of home performance as it relates to other homes when they lack the training and certifications to do energy assessments.

There is also growing evidence that new energy-efficient homes are in demand and valued at higher prices than other homes. A new study conducted by Freddie Mac reported on 70,000 homes rated under RESNET's HERS between 2013 and 2017.[38] The report's goal was to ''understand the value and the loan performance associated with energy-efficient homes to support the consideration of energy efficiency in mortgage underwriting practices.'' The findings include analysis of property value, loan performance, default risk, borrower characteristics, and demographics. The report found that HERS rated homes sold, on average, 2.7 percent more than comparable unrated homes. In addition, homes that received lower (*i.e.,* more energy efficient) HERS Index Scores sold for 3–5 percent more than homes with higher HERS Index Scores. The study also looked at loan performance, with several important findings: the default risk of energy-rated homes is not on average different from un-rated homes—and loans in a high debt-to income (DTI) range (45 percent and above) that have energy ratings ''appear to have a lower delinquency rate than unrated homes.'' In rural areas, there are reports of energy efficient and resilient homes commanding higher sales prices: two homes of two bedrooms and one bath each, built by Habitat for Humanity to high performance standards of Phius and ZERH as well as to the hurricane standard of FORTIFIED in Opelika, Alabama appraised at the equivalent amount of the standard Habitat for Humanity home of three bedrooms and two bathrooms.[39]

The cost and income approaches to valuation may help assign a contributory value to energy efficiency features of a home. The FHA Single Family Housing Policy Handbook 4000.1 provides for three types of home appraisal approaches applied to one-to-four-residential unit properties: the sales comparison approach, the cost approach, and the income approach.[40] However, the Handbook states that ''(t)he Appraiser must obtain credible and verifiable data to support the application of the three approaches to value. The Appraiser must perform a thorough analysis of the characteristics of the market, including the supply of properties that would compete with the subject and the corresponding demand. The Appraiser must perform a highest and best use of the Property, using all four tests and report the results of that analysis.''

HUD and USDA are considering taking several steps to address the appraisal gap issue:

First, FHA will provide outreach and training to market participants, including lenders and appraisers detailing the impact of this Final Determination and promoting awareness and education about energy efficient improvements. This will include training for both underwriters and appraisers on how the cost or income approaches can be used as part of appraisals in certain markets.

Second, HUD will work with USDA to provide a package of training through HUD's Community Compass Technical Assistance program aimed at educating appraisers and lenders about acceptable methods and techniques for accurately appraising energy efficient homes financed with an FHA-insured mortgage, including the proper use of the cost and income approaches. HUD has allocated FY22 funding to support this technical assistance.

Third, FHA's four Homeownership Centers (HOCs), which already provide training for appraisers and lenders, will include targeted training for the roster of FHA-approved appraisers, with an emphasis on places with a high volume of FHA-insured new home sales in the south and southwest.

Ultimately, the extent and impact of the appraisal gap for energy efficiency measures is a concern but does not change HUD and USDA's overall determination. While the appraisal gap indicates a failure in the market to keep pace with innovative energy efficiency measures, the gap does not exist in all markets, and its impacts can be alleviated by interventions such as increased market awareness, appraiser education, and resources such as the Green MLS for greater transparency and the Green Addendum to appraisal reports, as well as by the higher valuation of new construction that can cover some or all of the costs of the energy efficient improvements. The resources outlined in this notice, along with HUD and USDA efforts outlined above, will aid in closing the gap for FHA borrowers and should serve as further motivation to overcome market barriers that impede efficiency.

6. Delegation of Legislative Power

Two commenters stated that the Cranston Gonzalez Act is either an improper delegation of legislative power to a private entity, the International Code Council and ASHRAE which promulgate the IECC and ASHRAE–90.1 respectively, or an improper divestment of the executive power to a private entity, and that HUD and USDA should rescind the preliminary determination until Congress passes legislation that affirms what standards should apply.

HUD–USDA Response: In issuing this determination, HUD and USDA are following the statutory directive of 42 U.S.C. 12709(d). The Cranston Gonzalez

[37] Doyle, Victoria and Bhargava, Abhay, The Role of Appraisals in Energy Efficiency Financing, Building Industry Research Alliance, National Renewable Energy Laboratory.

[38] Argento, Robert et al, Energy Efficiency: Value Added to Properties and Loan Properties, *https://sf.freddiemac.com/docs/pdf/fact-sheet/energy_efficiency_white_paper.pdf.*

[39] Rural Studio, *https://ruralstudio.org/auburn-opelika-habitat-homes/.*

[40] *https://www.hud.gov/program_offices/administration/hudclips/handbooks/hsgh.*

National Affordable Housing Act of 1990 (Cranston-Gonzalez), as amended by the Energy Independence and Security Act of 2007 (EISA) (Pub. L. 110–140), requires HUD and USDA to establish energy efficiency standards for housing specified in 42 U.S.C. 12709(a)(1).

The original efficiency standards were required to meet or exceed the requirements of the 2006 International Energy Conservation Code (2006 IECC) and the American Society of Heating, Refrigerating, and Air-Conditioning Engineers Standard 90.1–2004 (ASHRAE 90.1–2004). (42 U.S.C. 12709(a)(2)). If the requirements of the 2006 IECC or the ASHRAE 90.1–2004 are revised, HUD and USDA must, within a year, amend their standards to meet or exceed the revised requirements of the 2006 IECC or the ASHRAE 90.1–2004, or issue a determination that compliance with the revised standards would ''not result in a significant increase in energy efficiency or would not be technologically feasible or economically justified'' (42 U.S.C. 12709(c)).

If HUD and USDA have not adopted the revised standards or made the determination under 42 U.S.C. 12709(c), then all new construction and rehabilitation of specified housing must meet the requirements of the revised IECC and ASHRAE 90.1 standards if HUD and USDA determine that the revised codes do not negatively affect the availability or affordability of certain housing stock specified in 42 U.S.C. 12709(d)(1) and DOE determines that the revised codes would improve energy efficiency. 42 U.S.C. 12709(d)). The present HUD/USDA determination fulfills HUD and USDA's statutory directive to determine whether the updated standards negatively affect availability and affordability. The commenter's stated interpretation of the Act does not dismiss HUD and USDA's statutory requirement to make this determination.

7. Lower Availability of Affordable Homes for Home Buyers

Several commenters shared concerns that the higher first or incremental costs associated with adopting the 2021 IECC over the current 2009 IECC would lower homebuyer options and/or limit the availability of housing to otherwise-qualified buyers or renters. Two commenters suggested that these high standards will result in fewer FHA and USDA constructed properties and limit the supply of housing in a way that contradicts HUD's mission.

HUD–USDA Response. The agencies appreciate the concerns raised by the commenters but do not agree that the higher standards will result in fewer FHA- and USDA-financed properties. HUD and USDA conducted thorough and extensive analyses on the impact of the 2021 IECC on affordability and availability, using established cost and savings methodologies that have been developed by DOE for multiple code cycles. The agencies determined that the codes will not negatively impact the affordability or availability of the covered housing. HUD and USDA recognize that, as of December 2023, only five states have adopted a code that meets or exceeds the 2021 IECC. Nevertheless, in those states, affordability and availability will, by default, not be impacted by HUD and USDA's adoption of the 2021 IECC because no additional requirements would be put in place above those already adopted by the state. In addition, while the number of states that have already adopted the codes is currently limited, the number is growing rapidly, with more than 20 states actively considering adoption of the 2021 IECC. State adoption of ASHRAE 90.1–2019 is more advanced than the IECC: ten states and the District of Columbia have adopted a code that meets or exceeds this standard, and a similar number of states (twenty or more) are currently considering its adoption. Additionally, many local jurisdictions have gone beyond the statewide residential or commercial code by adopting the 2021 IECC or ASHRAE 90.1–2019.[41]

Nevertheless, the agencies recognize that it will be necessary for builders who are accustomed to the requirements of the 2009 IECC and ASHRAE 90.1–2007—the current HUD and USDA standards—to familiarize themselves with the verification methods incorporated into the subsequent versions of the code (including blower door and duct testing). HUD and USDA will provide technical assistance and training resources to aid in the implementation of these new standards, as described in more detail in section A.2. above. These resources will address elements of the verification requirements for the 2021 IECC that could be unfamiliar to some builders. As these builders become familiar with these requirements and construction practices, the energy improvements required by the more current codes will strengthen the quality of the built product and will benefit consumers in the long term as a result of high-quality construction.

8. Affordability and Availability Impacts in Rural Communities

Three commenters expressed concern regarding the specific impact that the proposed code requirements would have on rural areas. One commenter suggested that challenges related to adoption or implementation of the 2021 IECC and ASHRAE 90.1–2019 standards would be more significant for rural areas ''because materials or workers may need to be transported from elsewhere, [and] [r]ural residents may not have easy access to specialized materials or specific worker skills when energy-efficient construction requires them. That is particularly likely in remote rural areas.'' One commenter, from the Umatilla Indian Reservation, stated that the reservation's rural location makes it particularly difficult to find contractors and access green products.

Another commenter, a trade association of rural housing organizations, also stated that rural areas would have a higher cost differential for a mortgage between the 2009 IECC and 2021 IECC than the $5,500 increase indicated in the preliminary determination due to construction costs that might be higher in rural areas. Factors that contribute to this higher cost include difficulty sourcing materials and limited access to an appropriately trained workforce for energy efficient construction projects. In addition, the commenter noted that the cost to the homeowner may be higher under USDA's Section 502 direct loan program, since the PNNL cash flow projections assumed a downpayment of 10–12 percent whereas Section 502 typically requires no downpayment and will therefore yield a higher mortgage amount.

Two commenters suggested that few contractors have the knowledge and resources to meet the proposed standards, and that it will be difficult to find a contractor to build to the proposed standards in states that have not or will not adopt the 2021 IECC.

One commenter pointed to specific challenges likely to be encountered by non-profit affordable housing developers: they suggested that affordable nonprofit housing developers will have trouble producing new rental and homeownership housing units in Appalachian communities with the proposed standards due to the ''increased costs to construct homes, the unique nature of [these] housing markets, and the difficulty in implementing the standard.'' As a result, the commenter argued that there

[41] Department of Energy, Municipal Building Codes and Ordinances. Updated December 2023. *https://www.energycodes.gov/infographics#Municipal.*

will be very few (if any) affordable new homes on the market that can be acquired by low to moderate income homebuyers or developers. The commenter urged HUD and USDA to consider the ability of their nonprofit partners to ''produce the same quantity of housing after increased costs in without any increase in funding support.''

HUD–USDA Response: The concerns noted by the commenters fall into three broad areas: the increased costs to build homes to the proposed standard in rural areas; the ''nature of rural economies and housing markets;'' and operational, technical, and other difficulties in implementing the standard.

In response to the comment about the potential impact of HUD and USDA energy code adoption on housing on Indian reservations, with the exception of the Section 248 program, which has a small loan volume (only eight outstanding loans, no new endorsements since 2008), HUD and USDA note that Indian housing programs are excluded from this notice because they are not covered under the requirements of the governing statute: they neither constitute ''assisted housing'' nor are authorized under the National Housing Act (12 U.S.C. 1701 *et seq.*) as specified in EISA. For example, the Section 184 guaranteed loan program is authorized under Section 184 of the Housing and Community Development Act of 1992 (42 U.S.C. 1715z–13a).

Increased Costs in Rural Areas

HUD and USDA agree that there are increased first costs associated with building to the higher energy standards outlined in the preliminary determination but conclude that the initial investment will benefit both Appalachian and all rural communities across the U.S. through energy cost savings to residents and as well as health, comfort, and durability of higher-performance housing. Rural communities will especially benefit from more energy efficient homes in that rural households are typically overburdened with higher energy costs as a percentage of household income. Nationally, the median rural household energy burden is 4.4 percent, almost one-third higher than the national rate of 3.3 percent and about 42 percent above the median metropolitan energy burden of 3.1 percent.[42] One commenter cited a Virginia Tech report on Appalachian housing costs that concluded that ''utility costs contribute to housing costs substantially'' in Eastern Kentucky, Southern West Virginia and the western section of Appalachian Alabama, where both owners and renters saw the highest costs relative to metropolitan areas.[43] For some low- or very-low income households, the energy bill may be greater than the cost of the mortgage. Energy bills fluctuate and are only billed post-usage, often leading to unexpected increases in these bills, which can create serious financial stresses on lower income households.

At the same time there are good examples in rural America of how better performing homes can alleviate the impact of higher energy costs experienced by lower income households. One such example is a USDA Rural Community Development Initiative (RCDI) grantee, Mountain T.O.P., a faith-based organization in Grundy County, Tennessee. Based in one of Appalachia's persistent poverty counties where a significant share of the housing stock is dilapidated, the organization worked closely with the Rural Studio Front Porch Initiative to build Mountain T.O.P.'s capacity to replace homes with new, high-performance homes to address the high energy burden in their community.

Despite the long-term affordability benefits of building high performance, energy efficient homes, rural areas may face first cost (and other) constraints in adopting construction standards or codes above prevailing local codes. HUD and USDA do not, however, agree that there is a broad and consistent impact for all rural areas across the nation. Geographic distance may play a role in creating challenges for construction projects in rural areas when there are not locally available skilled workers, but this is true of all building construction, regardless of the specific codes that are in place.

While both HUD and USDA programs serve rural areas, USDA is especially focused on rural housing through its Rural Housing Service programs. USDA's Single Family Direct Loan program is the only direct mortgage product offered by the federal government; USDA can and does work intensively through its underwriting process to assist rural, low-income borrowers to become and to remain homeowners. This program offers 100 percent financing, zero downpayment and the ability to amortize beyond 30 years in addition to having an interest rate that is below market. It is also able to offer additional subsidies based on need. Borrowers of this program, of all the single family borrowers impacted by this notice, are likely to benefit the most from the proposed adoption of the 2021 IECC, and the addition of homes built to higher performance quality will generate long-term benefits to rural locations where housing quality has lagged behind.

One commenter raised a concern that Direct Loan borrowers would see higher costs since downpayment requirements can be as low as zero, and to the extent that the additional costs would need to be financed, this would make these loans less affordable. USDA believes that this concern is misplaced since, by eliminating the downpayment requirement, the Section 502 loan in fact removes a significant potential barrier to financing the added first costs of the IECC, and, given the very low interest rates associated with this product, this seems like an optimal financing vehicle available to rural borrowers for energy efficient housing.

The commenter also raised concerns regarding appraisals, and the ''appraisal gap'' in rural areas. These concerns are addressed in the larger appraisal discussion in section A.3 of this notice. The limitations of the current appraisal process are broadly applicable, but the gap may be higher in rural areas due to fewer available sales comparisons in these areas, as well as fewer appraisers qualified to assess energy efficient or other green features of a home, *e.g.,* solar. The agencies acknowledge that the current appraisal system in the U.S. for single family homes is not generally set up to fully account for energy efficiency or renewable energy but have proposed potential actions that can help close the gap for FHA and USDA borrowers, as discussed in-depth in section A.3 above.

Technical Capacity Issues in Rural Areas

Other difficulties besides the added cost noted by commenters included limited technical capacity and the need for workforce training in rural areas. HUD and USDA believe that contractors have or are capable of obtaining the knowledge and resources to meet the proposed standards before commencement of the applicable compliance period. The commenter does not provide evidence as to the basis of this proposition. As discussed elsewhere in response to similar comments, the agencies recognize that there will be places where builders may

[42] Lauren Ross et al, the High Cost of Energy in Rural America, ACEEE, 2018. *https://www.aceee.org/press/2018/07/rural-households-spend-much-more.*

[43] Virginia Center for Housing Research at Virginia Tech, *Housing Needs and Trends in Central Appalachia and Appalachian Alabama,* 2018.

not be familiar with energy code requirements, but these are likely to be more the exception than the rule, especially with regard to larger home builders who build a significant portion of homes, and unequivocally with regard to multifamily housing.

HUD and USDA agree that remote rural areas may not always have the proper skilled professionals to execute certain types of construction and that training may be needed. Training and support are planned by the two agencies to assist rural America in achieving homeowner financial sustainability through building to the most current energy codes. Trainings on standards that exceed energy codes (Energy Star New Homes, Zero Energy Ready Homes) are also available from EPA and DOE, while additional tax credits for affordable multifamily housing as well as electrification rebates are also becoming available to build energy efficient housing, discussed in more detail in section A.3 above.

HUD and USDA also agree that building codes that require on-site inspection are more challenging in rural areas than where building sites are located in close proximity to HERS rater, building inspector or verifier, but given that HUD and USDA already require the 2009 IECC these issues will not materially change with the adoption of an updated code. The increase in energy codes from the 2009 IECC to the 2021 edition will indeed require learning and implementation of new skills and project delivery methods, but these are relatively modest and likely limited to energy modeling, blower door testing, and duct leak testing. Note that these testing methods have been in place at least since the 2012 edition of the IECC.

As discussed in response to other comments in this notice, HUD will partner with USDA in implementing a training and technical assistance program to facilitate implementation of the energy codes requirements, including trainings on these blower door and duct testing skills. Additionally, USDA is exploring the feasibility of and potential for remote-hybrid inspections with RESNET and others, in which third-party verification may be completed remotely with the on-site assistance of individuals who have received minimum training to perform testing tasks such as blower door testing, duct leakage testing and infrared camera techniques but who may not yet be fully certified home raters.[44]

Finally, in recognition of the specific capacity constraints identified in Appalachia and other high needs rural areas to adopting these standards, HUD and USDA will provide a longer lead time for adoption of the IECC and ASHRAE 90.1 standards in these areas, as outlined in the Implementation section of the Final Determination, section VI. An additional year of compliance will be provided in persistent poverty rural areas, as defined by USDA's Economic Research Service, including persistent poverty census tracts located in rural (non-metro) counties.[45]

9. Limited Cost Effectiveness of Individual Code Measures

One commenter suggested that HUD and USDA should evaluate the cost effectiveness of individual measures in the 2021 IECC and amend those measures that do not provide value to the consumer. Relying on the overall cost-effectiveness ''masks the extremely low-cost effectiveness of some of the individual measures by averaging the results with the measures that are more cost effective.'' The commenter identified two specific measures as not meeting any reasonable cost effectiveness test: ceiling insulation requirements of R–60 in Climate Zones 3–8 and R–49 in Climate Zones 1–2; and wall insulation requirements of R–20+5 or R–13+10 in Climate Zones 4–5. The commenter indicated that on their own these measures do not meet ''any reasonable cost-effectiveness test'' and provided data showing paybacks of 63–150 years on these items.

The commenter noted that these two problematic measures were considered by the 2024 IECC consensus committee. These were realigned to their 2018 levels in the draft 2024 IECC or were provided an opt-out provision in exchange for an additional three credits in Section R408 (Additional Efficiency Requirements). The commenter recommended that in lieu of evaluating all individual measures in the 2021 IECC, the agencies should allow similar amendments to the 2021 IECC as has been approved for the 2024 IECC. Another commenter suggested that HUD and USDA review the determinations made on both codes and identify provisions that do not increase energy efficiency and exclude them as requirements.

HUD–USDA Response. The statutory requirement (Section 109(d) of the Cranston Gonzalez Act of 1990) for this notice requires HUD and USDA to make a determination on the latest ASHRAE 90.1 or IECC code editions as published. It does not allow for selecting only the most cost-effective measures in the code. The overall efficiency of the code relies on a package of measures considered and adopted by consensus during the code development process, with the more cost-effective measures essentially supporting less cost-effective measures. Therefore, HUD and USDA do not have the ability to pick and choose between specific amendments to the code. In addition, the conventional practice by DOE has been to consider the combined costs and savings for the entire code, rather than for each amendment separately. HUD and USDA believe that it is sound policy to align with DOE practice and cost-benefit methodologies for the purpose of this notice.

Even if allowed under the statutory constraints of this notice, unpacking the code to consider each amendment individually contradicts standard practice when implementing energy efficiency measures. Energy codes typically consider a bundle of measures that enable longer-payback measures to balance out shorter-term measures and enable the savings of the shorter payback items to pay for those that on their own may be less cost-effective. For example, codes combine shorter payback lower-cost lighting measures with more efficient windows that typically have longer paybacks when installed in isolation from other measures. In addition, the agencies believe that the combination of mandatory and optional measures as well as two performance paths provide builders with a great deal of flexibility in complying with the 2021 IECC.

HUD and USDA are aware that the two insulation amendments to the 2021 IECC cited by the commenter have been incorporated in the draft 2024 IECC, which is currently scheduled for publication in early 2024. As noted above, these amendments would roll back ceiling and wall insulation requirements for certain climate zones to the 2018 level, or provide for an opt-out, in exchange for an additional three energy efficiency credits. While HUD and USDA are not able to accept

[44] Third-party verification is an increasingly common mechanism for enforcing building codes in localities with a limited number of code officials capable of doing so. A third-party code verification program utilizes private sector organizations to verify energy code compliance by providing plan review and analysis, performance testing, and field inspections. More information on third-party verification is available at *https://www.eepartnership.org/wp-content/uploads/2015/07/Third-Party-Verification_Best-Practices_10-15-14-final.pdf.*

[45] USDA, Economic Research Service, Poverty Area Measures, Descriptions and Maps, *https://www.ers.usda.gov/webdocs/charts/105111/persistentcountytracts.png?v=7741.2.* See also USDA ERS definition of rural (non-metro) counties at *https://www.ers.usda.gov/topics/rural-economy-population/rural-classifications/.*

individual amendments such as this one to the 2021 IECC, if, after publication of the 2024 IECC, DOE determines that the revised code is more energy efficient than the 2021 IECC, housing built to comply with the 2024 IECC in its entirety will meet the requirements of the 2021 IECC.

HUD and USDA note that PNNL has conducted a preliminary analysis of the savings associated with the proposed 2024 IECC, and that DOE's preliminary cost-benefit analysis indicates that the 2024 IECC will exceed the energy efficiency of the 2021 IECC by approximately 6.7 percent. Energy cost savings are estimated to increase by approximately 6.4 percent.[46]

The savings result from the following measures: Additional energy efficiency credits (10 energy credits); Fenestration Table—Improved Window and Skylight U-factors in Climate Zones 4C—8; Ceiling Insulation changes in Climate Zones 4–8 from R–60 to R–49; Climate Zones 6–8 to 2.5 ACH50; Pipe Insulation Requirements update (1 inch thickness = R7); Heat Recovery Ventilator required in Climate Zone 6.

10. Understated Impact on Low-Rise Multifamily

One commenter suggested that the Regulatory Impact Analysis (RIA) is ''seriously flawed'' because it inadequately considers the impact of the 2021 IECC on low-rise multifamily construction and fails to give appropriate regard to the potential impact on the availability of affordable housing for low-to-moderate income renters. Another commenter questioned the use of a 30-year period of analysis, which the commenter says ignores investment and construction cost considerations for rental apartment investors that work on shorter investment horizons of a 10-year maximum.

HUD–USDA Response: As stated in the preliminary determination, the 2021 IECC may impact an estimated 170,000 housing units of HUD- and USDA-financed or -insured housing, which includes single family and low-rise multifamily housing. The majority of impacted units will be single family (86 percent); additionally, single family housing faces a greater estimated incremental cost when compared to low-rise or high-rise multifamily. As such, it is reasonable for the bulk of the analysis to center on the most significantly impacted housing type; however, HUD and USDA recognize the need to provide additional detail on availability impacts to low-rise multifamily housing. HUD estimates approximately 27,000 low-rise multifamily units may be impacted by this notice; all are HUD-financed since USDA multifamily programs are not covered by this notice.

When considering impacts on the availability of affordable housing, the economic rationale remains consistent when considering impacts for each housing type; the percentage change in the quantity of housing depends on the price elasticity of demand, price elasticity of supply, and incremental cost. The 1.5 percent reduction cited in the Regulatory Impact Analysis (p.80) applies broadly to housing, meaning that this rate holds for both single family and low-rise multifamily. As such, the maximum number of negatively impacted units is 405 units out of the 27,000 units of low-rise multifamily housing that are estimated to be impacted by this notice.

Existing energy efficiency programs make building to a higher standard more accessible for subsidized housing compared to market-rate housing. A report from DOE's Office of Scientific and Technical Information found that low-rise multifamily buildings were often designed to higher standards in order to qualify for additional energy efficiency certification programs.[47] The Low Income Housing Tax Credit program often requires above-code energy efficiency measures through state Qualified Allocation Plans, resulting in many affordable low-rise multifamily projects that are already being built to higher above-code standards, *e.g.,* Energy Star for New Construction or Passive House.

As far as impacts on renters, the energy efficiency improvements required by the most recent energy codes will provide health benefits in addition to reductions in energy expenditures for families living in rental housing, circumventing the split-incentive issue of landlords being unwilling or uninterested in improving the quality of rental housing for their tenants.

A 30-year period is used in HUD and USDA's affordability analysis following the well-established methodology developed by DOE for assessing the cost effectiveness of the IECC.[48] HUD's Regulatory Impact Analysis provides additional detail (p. 25). In response to the comments that investors in rental apartments typically rely on a 10-year timeline, HUD and USDA added Tables 17 and 18 to the final determination. These show the cash flow for single family and low-rise multifamily housing, respectively. For each building type, the cash flow is positive by the end of the second year, and the simple payback for the national average occurs after 7.7 years in both cases.

Additionally, it should be noted that this is only applicable to low-rise multifamily; mid-rise and high-rise multifamily buildings are required to meet the ASHRAE 90.1–2019 standard, which shows national average cost increases of only $208 per dwelling unit and negative cost increases for certain states and climate zones (meaning adopting the new standard saves money). Nationally, the simple payback is immediate with 40 states receiving immediate payback and South Dakota having the longest payback period of 1.6 years.

B. Current Status and Anticipated Timetable for State and Local Adoption of the Next Revision of the IECC and/or ASHRAE Codes

HUD and USDA requested comments from code officials on the current status of code adoption in their states, and the anticipated timetable for adopting the next revision of the IECC and/or ASHRAE 90.1 codes. No comments were submitted on the specific question of proposed timetables for state and local adoption of subject codes. However, multiple comments were received that expressed concerns regarding the interaction or alignment between the HUD and USDA proposal and state and local adoption of prior codes. These are discussed below.

1. Alignment of HUD and USDA Standards With State and Local Codes

Several commenters shared concerns regarding the transition that would be required to implement the 2021 IECC and ASHRAE 90.1–2019. Commenters cited the lack of alignment with state or local home rule adoption of these codes. One commenter suggested that the proposed standards would conflict with local building codes, causing delays in construction and significant cost impacts. One commenter suggested that HUD and USDA align implementation of the 2021 IECC with state and local government efforts for updating their energy codes to avoid placing major challenges on builders and local code enforcement officers. One commenter suggested that HUD and USDA accept

[46] PNNL for DOE, Energy Savings Analysis 2024 Residential IECC Interim Progress Indicator.

[47] DOE, Office of Scientific and Technical Information, Residential Building Energy Efficiency Field Studies: Low-Rise Multifamily (Technical Report), *https://www.osti.gov/biblio/1656655/.*

[48] PNNL, Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes, prepared for DOE, *https://www.energycodes.gov/sites/default/files/2021-07/residential_methodology_2015.pdf.*

the two most recent versions of the IECC and ASHRAE 90.1 standards to help alleviate compliance issues for states and localities with code requirements below the proposed standards.

HUD–USDA Response: The statutory framework for this notice requires HUD and USDA to align their codes with the latest editions of the specified codes, *i.e.,* the 2021 IECC and ASHRAE 90.1–2019. The statutory requirement at Cranston Gonzalez Section 109(d) does not provide for substituting state-adopted codes (or previous editions as suggested by one commenter) for this cohort of HUD- and USDA-financed new buildings. The intent of the statute is for HUD and USDA to adopt the latest edition of the codes independent of the codes that states have adopted, provided that these do not negatively impact the affordability and availability of the subject homes.

HUD and USDA recognize that this above-code requirement (in states or localities that have not yet adopted the latest editions of the codes) will require builders, developers, and designers to familiarize themselves with the requirements of the new codes. However, the agencies note that it is *not* expected that local code officials will be required to ensure compliance with or enforce the proposed standard. The agencies will not rely on local code officials to certify compliance with the HUD and USDA requirements, and therefore local building inspectors will not be expected to familiarize themselves with the HUD and USDA requirements should they differ from the prevailing state or local code. Rather, HUD and USDA will rely on existing builder self-certification requirements and will also put in place a technical assistance and training program to educate and inform builders, architects, engineers, and developers about the requirements of the standard.

Additionally, there are some jurisdictions that do not adopt building codes at all, and federal agencies must provide prudent guidance and protection of consumers, taxpayers, and housing assets by requiring an industry-accepted code as a standard for all types of project development.

As noted, HUD and USDA's statutory requirement to consider adoption of the latest editions of the code does not allow acceptance of the previous 2018 IECC and ASHRAE 90.1–2016 editions as a compliance pathway, as suggested by one commenter, since these editions have been determined by DOE to be less efficient than the current standards. However, as has been standard practice, all subsequent versions of the IECC and ASHRAE 90.1 that have been determined by DOE to meet or exceed the energy efficiency of the 2021 IECC and ASHRAE 90.1–2019, are sufficient to meet the requirements that will go into effect as a result of this notice. Additionally, there are now significant federal incentives and encouragement from federal agencies for builders to achieve even higher energy performance through, for example, the Department of the Treasury's section 45L tax credit of up to $2,500 for homes that are certified as meeting the requirements of the EPA's Energy Star Single Family Homes or the Energy Star Multifamily Homes National Program (but do not meet the ZERH standards) and up to $5,000 for homes that are certified as meeting the requirements of DOE's ZERH program. Both the EPA's Energy Star Programs and DOE's ZERH's programs require minimum compliance with the most current energy code (2021 IECC) and energy performance of at least 10 percent better. It is anticipated that many builders will take advantage of these tax incentives—as well as rebates that will become available in 2025 or earlier for electric heat pumps and other building electrification measures—and in the process achieve energy efficiencies that are well above the 2021 IECC. Additionally, 45L tax credits of up to $2,500 per unit for Energy Star Multifamily New Construction and up to $5,000 per unit for DOE Zero Energy Ready Homes for multifamily homes are available for multifamily builders that meet prevailing wage requirements.

2. Adoption of Earlier Versions of the Energy Codes

One commenter stated that requiring the IECC 2021 breaks with the precedent established by HUD and USDA in 2015 of selecting an attainable code standard for states rather than the most recently published version. The commenter pointed out that in 2015, HUD established the baseline requirement of 2009 IECC despite newer versions having been published by that time; the commenter recommended that HUD and USDA delay this update until more states adopt the most recent versions of the codes or opt for the 2018 IECC as the requirement.

HUD–USDA Response. The authorizing statute for this notice requires HUD and USDA to adopt the most recent edition of the IECC and does not provide for consideration of prior editions; the delayed adoption of the 2009 IECC by HUD and USDA in 2015 was a function of the length of time the regulatory process took to publish a final determination on the 2009 IECC, not to establish a precedent for future adoption.

Further, the statute does not allow HUD and USDA to tie adoption by HUD and USDA of the most recent edition of the code to the number of states that have adopted that code. Specifically, section 109(d) of Cranston-Gonzalez (42 U.S.C. 12709) provides that revisions to the IECC or ASHRAE 90.1 codes will apply to the housing specified in the statute if: (1) either agency ''make(s) a determination that the revised codes do not negatively affect the availability or affordability'' of such housing. HUD and USDA therefore do not have the statutory authority to delay adoption of the most recent code until ''more states'' have adopted the code. The agencies note, however, that the number of states considering or adopting the revised standards is growing and is expected to grow further as a result of newly available IRA or BIL funding from DOE to support state adoption of the 2021 IECC or higher energy standards. As of December 2023, while only five states have already adopted the 2021 IECC, more than 20 additional states are actively considering its adoption.

HUD and USDA recognize that this presents challenges for developers and builders with regard to adopting a standard that may be above the prevailing locally adopted state or local code, but the governing statute for this notice limits the factors to be considered by HUD and USDA to ''affordability'' and ''availability;'' it does not provide for accepting alternative state or local codes as a compliance path. If HUD and USDA were to wait until more states had adopted the 2021 IECC, this would undermine the purpose of the governing legislation, which is to strengthen the standards for HUD- and USDA-financed new construction separately from state adoption provided that these were found to meet the affordability and availability standards.

3. IECC and ASHRAE 90.1 Alignment With State and Local Code Amendments

One commenter noted that the adoption of the 2021 IECC and ASHRAE 90.1–2019 creates ''hurdles in states that have not yet adopted these versions of the codes or have amended the codes so they are not deemed equivalent.'' The commenter suggested that HUD and USDA should ''conduct further due diligence on these issues'' to better understand the practical impact of updating the code requirements.

One commenter suggested that HUD and USDA postpone issuing the final determination until a critical mass of states adopt the 2021 IECC and ASHRAE 90.1–2019 standards. The commenter stated that prematurely enforcing these new standards will lead

to jurisdictions being unprepared to review or verify compliance; construction trades being untrained in implementing the new energy efficiency measures; builders, developers, and designers not being ready to transition to the new standards; third-party verification organizations being unprepared to certify compliance; appraisers not being able to recognize the added costs in valuations; and coordination with other code requirements at the jurisdictional level having limited time, leading to non-compliance and performance issues.

HUD–USDA Response. As noted in the above response, HUD and USDA recognize the potential challenges regarding compliance with the statutory requirement to adopt the most recent edition of the codes that may exceed the standards adopted by a state or locality. The preliminary determination provided an extensive discussion and analysis of the impact that adoption of the 2021 IECC would have on the availability of agency-financed housing. In places which have a significant share of FHA-insured or HUD-financed housing, including California (7,977 total units), Florida (22,607 total units), Georgia (9,736 total units), North Carolina (8,432 total units) and Texas (41,230 total units), HUD and USDA have determined that builders are more likely to build to the standards covered under this notice.

HUD and USDA also note that state adoption is an ongoing process: as of December 2023, only five states have adopted a code that meets or exceeds the 2021 IECC; however, five additional states have adopted the 2021 IECC, although with weakening amendments. Additionally, a significant number of states are currently actively considering the adoption of this standard (with or without amendments). Some 20 states are currently considering adoption of the 2021 IECC; when combined with the 10 states that have already adopted the 2021 IECC, or codes that meet or exceed the 2021 IECC, these states represent approximately 50 percent (an estimated 80,000 units) of HUD and USDA financed units projected to be impacted by this determination.

In summary, while the statute specifically limits HUD and USDA's ability to tie code requirements to the level or extent of state adoption of these requirements, from a practical point of view the pipeline of states currently considering or projected to adopt the 2021 IECC discussed above indicates that by the time the HUD and USDA 2021 IECC requirement takes effect, many more states will in fact have adopted the 2021 IECC or its equivalent, thereby aligning the HUD and USDA standard more directly with state or local code adoption. Additionally, HUD and USDA will put in place a technical assistance and training program to better enable builders, architects, and engineers to meet the 2021 IECC and ASHRAE 90.1–2019 standards.

C. Cost-Benefit Methodology Utilized by Pacific Northwest National Laboratory (PNNL) as Described in the Preliminary Determination

HUD and USDA requested comments on the methodology developed by PNNL and used by the agencies for their affordability analysis. Most comments received in response to this question were in support of the PNNL cost-benefit analysis. One commenter presented their own analysis, conducted by ICF, which aligns with the PNNL analysis and found that the 2021 IECC is cost effective when compared to the 2018 IECC across all climate zones.

However, some commenters shared concerns regarding the methodology used in the cost-benefit analysis. Among these concerns, two commenters expressed that the PNNL study overestimated the value of future savings, particularly for low-income buyers. Others raised concerns with the incremental costs, as well as the economic factors used to estimate cash flow and life cycle savings. One commenter presented an analysis prepared by Home Innovation Research Labs (Home Innovation) disputing PNNL's analysis, showing significantly higher cost estimates than the PNNL costs used by HUD and USDA for their analysis.

HUD–USDA Response: HUD and USDA acknowledge the many supportive comments on the cost-benefit analysis included in the preliminary determination. This analysis accurately reflected the economic landscape at the time of development in 2020. In addition, HUD and USDA reviewed the independent cost-benefit studies referenced in the public comments, one of which, by ICF, affirms PNNL's analysis and one of which (Home Innovation) disputes PNNL's analysis.

In general, HUD and USDA affirm the original analysis and methodology conducted by PNNL used by the agencies in the preliminary determination; however the agencies recognize that significant time has elapsed since the analysis was conducted in 2020 and have accordingly revised their analysis to include updated economic factors that better reflect current market conditions, including a significant increase in construction costs to reflect the supply-chain and other factors that have impacted construction costs from 2020–23. The appropriate tables have been revised in the final determination.[49]

1. Construction Cost Estimates

One commenter stated that the construction costs used in the PNNL analysis are substantially lower than the current market costs. The commenter included a summary of alternative cost estimates based on Home Innovation's analysis which demonstrates a much more significant (negative) impact on affordability.[50] The commenter also stated that the cost effectiveness analysis should consider the amount paid by the consumer as well as the builder, *i.e.,* should include builder gross profit margins as a cost factor.

[49] The final determination uses the same cost effectiveness methodology as the RIA, which HUD developed based on PNNL's incremental cost and energy cost savings figures. A key difference between the methodologies is that PNNL includes residual value and replacement costs in their calculation. Page 25 of the RIA explains why these factors are not included in this alternative methodology.

[50] Home Innovation Research Labs, 2021 IECC Residential Cost Effectiveness Analysis, June 2021, *https://www.homeinnovation.com/-/media/Files/Reports/2021-IECC-Residential-Cost-Effectiveness-Analysis.pdf.*

HUD–USDA Response: The analysis produced by PNNL was developed with a methodology that underwent a rigorous public comment and peer review process, has been used for cost-benefit analysis of the revised editions of the IECC and ASHRAE since the 2006 IECC. The Home Innovation report and a response report developed by ICF are independent, third-party studies that include additional data and analysis but are not peer reviewed nor do they follow a federally approved methodology. HUD carefully reviewed the cost estimates provided in the Home Innovation report. The agency recognizes that the incremental cost estimates in the Home Innovation report are two to three times higher than those estimated by PNNL, but ultimately determined that the current analysis' approach and findings most accurately represent accepted means of assessing building energy code impacts, including anticipated cost impacts. Additionally, there are other entities (ICF) that estimate lower cost increases than those calculated by DOE/PNNL.

It is important to note that both independent studies show consensus with the PNNL energy savings estimates used by HUD and USDA in their determination. Home Innovation concluded that energy savings from adopting the code would range from 6.4 percent to 11.6 percent depending upon the additional option chosen. For the basic package plus the water heater option, Home Innovation found a reduction of 9.7 percent of energy expenditures. This range is similar to the estimate reported by PNNL of 8 percent for single family homes (see RIA Figure 11).[51] However, the cost-effectiveness analysis conducted by Home Innovation estimates significantly higher incremental costs for the 2021 IECC over the 2018 IECC, ranging from $6,548 to $9,301 per house on average, compared to the government estimate of $2,372 per home; while the Home Innovation savings estimates are the same as those estimated by DOE, the higher estimated cost in the Home Innovation report result in significant differences in estimated simple payback periods for the initial investment.[52]

With regard to construction cost estimates, the agencies would expect there to be slight differences in the cost estimates given the variety of building types, methods of compliance, costs of materials, and quantity of materials. However, the differences between these the PNNL and Home Innovation estimates are unusually large: HUD and USDA attribute such a large difference to two factors: Home Innovation's assumption of a high profit margin and differences between the configuration of the model homes used by PNNL and Home Innovation respectively.

The representativeness of the Home Innovation and PNNL data are not equivalent. The set of prototypes PNNL uses in its analysis are designed to represent the majority of the new residential building construction stock in the United States using a combination of U.S. Census, RECS, and Home Innovation data. DOE's established methodology uses a suite of representative residential prototype buildings, including a single family and a low-rise multifamily residential building, each with four different foundation types (*i.e.,* slab-on-grade, vented crawlspace, heated basement, unheated basement) and four heating system types (*i.e.,* gas furnace, electric resistance, heat pump, fuel oil furnace). The Standard Reference House by Home Innovation is primarily based on the results of the 2008–2009 Annual Builder Practices Survey (ABPS). The ABPS is an annual national survey of builders that gauges national and regional building practices and material use. This survey represents a comprehensive source of general housing characteristics in the United States and contains information on building square footage, wall square footage, climate-based foundation type, climate-based wall construction type, and other residential construction characteristics. The parameters represent the average (mean) values from the survey for building areas and features not dictated by the 2006 IECC.

The Home Innovation study calculates the unit cost of any change and adds to that an overhead and profit premium of approximately 27 percent. For example, the incremental cost to the builder of installing a square foot of ceiling insulation is 59 cents per square foot, which is derived by inflating the 46-cent incremental cost by the overhead premium. The total incremental cost to the producer is given by the inflated unit cost of 59 cents and the quantity (1,875 square feet of ceiling insulation) to settle on an estimate of $1,106. The cost paid by the consumer is assumed to be the cost to the producer plus a return of 23.5 percent on the change in costs. The cost to the consumer of requiring thicker ceiling insulation would then be $1,366 ($1.235 \times \$1{,}106$).[53] Adding these markups on incremental costs would inflate the cost estimate by 57 percent (1.27×1.235).

The design of the home plays a role by determining the quantity of insulation. The model single family homes of PNNL are similar in terms of living space (floor area). The Home Innovation model is less dense, however, and has more of its floor area in the first floor than the second floor. A low-density design leads to larger areas exposed to the exterior and in need of insulation. For example, although the floor area of the Home Innovation home is only 5 percent greater, the ceiling area requiring insulation is 56 percent greater.

The profit assumption combined with the design of the home would lead to cost estimates approximately 2.2 times larger than the PNNL analysis. (The PNNL cost estimates include a 15 percent overhead and profit.)

While HUD and USDA continue to rely on PNNL construction cost estimates, the agencies recognize that construction costs have increased since the original analysis was conducted of the 2021 IECC. Accordingly, a supply chain cost increase factor of 37 percent has been applied to the incremental cost of adopting the new code to account for the increase in inputs for residential construction over the 2020–23 period. The 37 percent increase is derived by from the Bureau for Labor Statistics' Producer Price Index for inputs to residential construction less energy and cited by the NAHB in their monthly Eye on Housing blog.[54] Tables 13–15 in the Final Determination have been updated to reflect this cost increase.

2. Builder vs. Consumer Costs

One commenter asserted that the PNNL analysis relied on by HUD and USDA is based on costs experienced by the builder and does not account for the full costs experienced by the homeowner, including mark-ups such as builder profit margin.

HUD–USDA Response: Profit margin is already included in the DOE/PNNL Methodology. The PNNL methodology for evaluating the impacts of building energy codes defines first cost as the marginal retail cost of implementing a

[51] *https://www.energycodes.gov/sites/default/files/2021-07/2021_IECC_Final_Determination_AnalysisTSD.pdf.*

[52] *https://www.nahb.org/-/media/NAHB/advocacy/docs/top-priorities/codes/code-adoption/2021-iecc-cost-effectiveness-analysis-hirl.pdf.*

[53] HUD expects that builder profits would diminish rather than increase from this regulation. The NAHB implies the reverse: that the increase in revenue is greater will be greater than the cost. It is more likely that profit rates will fall.

[54] Producer Price Index Report, *https://www.bls.gov/news.release/ppi.nr0.htm.* See NAHB, Eye on Housing, Building Materials Prices Fall for Second Month Straight, *https://eyeonhousing.org/2023/06/building-materials-prices-fall-for-second-month-straight/.*

code change. This includes the price experienced by the home buyer, including materials, labor, equipment, overhead, and profit. A factor of 15 percent is included for overhead and profit.

3. Reliance on Simple Payback vs. Life Cycle Cost Savings

Another commenter cited an independent cost analysis by ICF of the Home Innovation report. The ICF analysis concluded that the Home Innovation analysis only evaluates cost effectiveness with a simple payback metric, which ignores many longer-term factors in the economic performance of an energy efficiency investment.

HUD–USDA Response: Beyond the specific figures cited by the commenter, the Home Innovation cost analysis is based solely on a simple payback metric which divides an incremental cost by the associated consumer cost savings to identify the time, typically in number of years, required to ''pay back'' the initial investment. While being a straightforward metric and relatively simple to calculate, it is not deemed sufficient to capture the full range of costs and benefits experienced by the home buyer. A life-cycle cost analysis is preferred as the widely accepted means of evaluating incremental costs of construction, including updated building energy efficiency standards, against expected consumer cost savings. The life-cycle approach accounts for the incremental costs of construction and consumer cost savings, as well as other costs and impacts experienced by the homeowner, including maintenance and replacement costs associated with a given measure. The Congressionally-recognized energy code development and consensus bodies, the International Code Council (ICC) and ASHRAE 90.1, both rely upon a life-cycle based approach for evaluating the cost impacts of their updated codes. As the Home Innovation analysis relies solely on simple payback, it is not directly comparable to the life-cycle cost analysis developed by PNNL and used in this notice by HUD and USDA. That said, USDA and HUD do include simple paybacks in their analysis, but provide it as a supplemental rather than primary measure of affordability.

4. Financing and Economic Factors Do Not Reflect Current Market Conditions

Several commenters raised concerns about certain economic factors used for the cash flow and Life Cycle Cost savings analysis in the preliminary determination and the RIA. The main concerns were with savings estimates, interest rates, down payments, discount rates, payback period, and applicability for typical FHA and USDA borrowers.

One commenter suggested that HUD and USDA should conduct additional analysis on the costs of compliance for their federal programs. Commenters stated that the PNNL analysis assumed an inflation rate of 1.4 percent and a mortgage rate of 3 percent while, as of July 2023, the inflation rate is 3.0 percent and mortgage rates are 6.97 percent. They also stated that the PNNL use of a 12 percent downpayment does not reflect the average downpayment for an FHA or USDA borrower, which are stated as 4.5 percent and zero percent respectively.

One commenter also suggested the cost effectiveness analysis used in the preliminary determination does not reflect the typical FHA and USDA borrowers for single family homes. The commenter suggested that ''HUD and USDA should conduct an independent analysis of the cost impact on the typical lending profiles for the borrowers that use their programs and customize the analysis to represent their clients more accurately.''

HUD–USDA Response: Regarding comments received on the economic factors used in the analysis, HUD and USDA address the effect of the relationship between the mortgage interest rate and the consumer's discount rate on mortgage affordability on page 31 of the RIA. Additionally, HUD and USDA did consider the differences in monthly mortgage payments and insurance premiums between HUD and USDA borrowers and the average borrower in PNNL's analysis. See pages 33–43 of the RIA for cash flow impacts to FHA and USDA borrowers.

At the same time, the agencies understand the significance of COVID–19 and global supply chain issues on factors such as inflation, interest rates, and energy prices. This issue is not unique to this final determination, as the ICC and DOE have also updated the economic factors proposed for determining the cost effectiveness of the 2024 IECC, as outlined below in Table 7.[55] These factors were agreed to by all stakeholders in the consensus process, including the home building industry.

Table 7. ICC Economic Factors for 2024 IECC Analysis

Parameter	Value	Source
Mortgage Interest Rate	3.84% nominal	Freddie Mac 5-year average
Loan Term	30 years	DOE 2021 Cost Effectiveness Analysis
Down Payment Rate	12%	DOE 2021 Cost Effectiveness Analysis
Points and Loan Fees	1%	DOE 2021 Cost Effectiveness Analysis
Discount Rates	3.84% nominal 7% real 3% real	30-year mortgage rate 2003 OMB Circular A-4 2003 OMB Circular A-4
Period of Analysis	30 years	
Inflation Rate	2.3%	EIA AEO 2021
Fuel price escalators	Electricity: -0.1% Gas: 0.5% Propane: 1.4%	EIA Annual Energy Outlook 2021 reference case, residential by fuel, national

[55] 2024 IECC Residential Cost Effectiveness Analysis Proposal, *https://www.iccsafe.org/wp-content/uploads/IECC_res_cost_effectiveness_proposal_final.pdf.*

HUD and USDA have used similar or equivalent sources, updated to reflect 2023 costs and fuel price escalators and mortgage interest rates to revise the economic factors used in the preliminary determination's affordability analysis to reflect current market conditions (Tables 13–16). This acknowledges the unusual circumstances of the recent four-year 2020–23 period, both with regard to increased mortgage interest rates as well as COVID-related supply chain shortages and associated cost increases. With these revisions, HUD and USDA have adopted a modified DOE methodology for the analysis. The analysis is based on the original cost effectiveness results from PNNL; however, it has been updated as described in response to several public comments. The economic parameters that have been revised are listed below in Table 8.

Table 8. Revised Economic Parameters for Final Determination

Parameter	Value	Source
Mortgage Interest Rate	Real: 3% Nominal: 5.3%	
Discount Rate	Real: 3% Nominal: 5.3%	Equal to Mortgage Interest Rate
Supply Chain Cost Increase Factor	37%	BLS Producer Price Increase
Energy Price Increase Factor	32%	EIA Natural Gas Prices, Electricity Prices, Heating Oil Prices
Fuel price escalator	1.9%	EIA Annual Energy Outlook 2023, Table 3. Energy Prices by Sector and Source. Prices in Nominal Dollars
FHA Savings Reduction Factor	3%	HUD Estimate
FHA Cost Reduction Factor	5%	HUD Estimate
Down payment	5%	Downpayment Factor (FHA and USDA borrowers)
Inflation	2.24%	First Quarter 2024, Survey of Professional Forecasters

These revisions better reflect impacts on HUD and USDA borrowers and also account for the higher cost of construction materials and labor, as well as increased energy prices over the past three years, as follows:

Economic Factors:

• *Construction cost increase (2020–23).* A supply chain cost increase factor of 37 percent has been applied to the incremental cost of adopting the new code to account for the increase in residential construction costs 2020–23. The 37 percent increase utilizes Bureau of Labor Statistics' Producer Price Index for inputs to residential construction less energy as reported by the National Association of Home Builders.[56]

• *Energy price increase (2020–22).* An energy price increase factor was developed by averaging price for electricity, natural gas, and heating oil for 2020 through 2022. The three-year averages were used to establish the rate of increase based on PNNL's original energy prices for each source. Finally, these rates were averaged based on the residential energy mix for 2022. Data for calculating the energy price increase factor was sourced from the U.S. Energy Information Administration.[57]

• *Energy price escalator.* A new fuel price escalator is used, based on the estimated 30-year trends in the Energy Information Administration's (EIA) 2023 Annual Energy Outlook.[58] While the energy price increase reflects historical increase in energy prices from 2020–23 and is used to estimate first year energy savings, the energy price escalator estimates future changes to energy prices over the full period of the analysis, changing the price for future years to align with the expected movement in energy prices over the 30-year mortgage. The escalator is set based on the projections with prices in nominal dollars.

Cash Flow and Financing Factors:

• *Mortgage interest rate.* A 5.3 percent nominal mortgage interest rate has been adopted, using DOE's established cost effectiveness methodology. HUD and USDA have based their analysis and the economic parameters on DOE's methodology wherever possible, despite incorporating some modifications to reflect the current economic landscape.

• *Discount rate.*[59] A 5.3 percent nominal discount rate (3 percent real discount rate) has been adopted for the purpose of this Notice. The discount rate reflects the time value of money. Following established DOE methodology, the discount rate has been set equal to the mortgage interest rate in nominal terms. Mortgage payment is an

[56] ''Building Materials Prices Fall for Second Month Straight,''| Eye On Housing, *https://eyeonhousing.org/2023/06/building-materials-prices-fall-for-second-month-straight.*

[57] EIA, Natural Gas Prices: Average Residential Price, *https://www.eia.gov/dnav/ng/ng_pri_sum_a_EPG0_PRS_DMcf_a.htm;* Heating Oil Prices: *https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=M_EPD2F_PRS_NUS_DPG&f=M*; Electricity Prices: Electricity data browser—Average retail price of electricity, *https://www.eia.gov/electricity/data/browser/#/topic/7?agg=0,1&geo=vvvvvvvvvvvvo&endsec=vg&linechart=~ELEC.PRICE.US-RES.A&columnchart=ELEC.PRICE.US-ALL.A&map=ELEC.PRICE.US-ALL.A&freq=A&start=2001&end=2022&ctype=linechart&ltype=pin&rtype=s&pin=&rse=0&maptype=0.*

[58] EIA, U.S. Energy Information Administration—EIA—Independent Statistics and Analysis, *https://www.eia.gov/outlooks/aeo/data/browser/#/?id=3-AEO2023&region=1-0&cases=ref2023&start=2021&end=2050&f=A&linechart=ref2023-d020623a.3-3-AEO2023.1-0~ref2023-d020623a.5-3-AEO2023.1-0&map=ref2023-d020623a.3-3-AEO2023.1-0&ctype=linechart&sourcekey=0.*

[59] Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes, U.S. Department of Energy, *https://www.energycodes.gov/sites/default/files/2021-07/residential_methodology_2015.pdf.*

investment available to consumers who purchase homes using financing, which makes the mortgage interest rate a reasonable estimate for a consumer's alternative investment rate.

- *Down payment.* Down payment has been revised from 12 percent used by PNNL to 5 percent to better reflect the HUD and USDA borrower. Note that this is somewhat higher than the minimum down payment required for FHA-insured mortgages of 3.5 percent, but the average down payment for new construction loans is somewhat higher than the minimum.
- *Other closing costs.* A 1.75 percent upfront mortgage insurance premium (MIP) to reflect current FHA requirements, a 0.55 percent annual MIP, and one percent variable closing costs are also included in the analysis.
- *FHA Typical Home Adjustment Factor.* An FHA cost adjustment factor and an FHA savings adjustment factor of 5 percent and 3 percent respectively were added to adjust the PNNL analysis to better reflect the smaller home size of a typical FHA or USDA property (2,000 sf) compared to a conventionally financed house modeled by PNNL (2,774 sf).

The relevant tables in the final determination have been updated to reflect these revised economic factors. Nationally, the updated economic factors have a minor adverse impact on the affordability of adopting the 2021 IECC. By way of illustration, Table 9 presents the new analysis included in the Final Determination using the revised economic factors (Table 13).

Table 9. National Costs and Benefits – 2021 IECC vs. 2009 IECC (Single Family)

Climate Zone	LCC Savings ($)	30 Year PV Benefits ($)	Incremental cost ($)	Annual energy savings ($)	Annual Mortgage Increase ($)	Down payment and other up-front costs ($)	Net annual cashflow for year one ($)	Years to positive cashflow	Simple payback (years)
National Average	15,071	25,124	7,229	963	439	550	377	1.5	7.7
CZ 1	10,774	15,866	3,662	608	222	279	311	0.9	6.2
CZ 2	8,313	15,871	5,436	608	330	414	168	2.5	9.2
CZ 3	13,917	25,093	8,037	961	488	612	311	2.0	8.6
CZ 4	19,989	31,965	8,613	1,225	523	656	527	1.2	7.2
CZ 5	17,691	28,467	7,750	1,091	471	590	463	1.3	7.3
CZ 6	29,834	39,409	6,886	1,510	418	524	952	0.6	4.7
CZ 7	39,308	51,604	8,843	1,977	537	673	1,261	0.5	4.6
CZ 8	52,078	64,377	8,845	2,467	537	673	1,750	0.4	3.7

The revised economic factors provide a revised estimate of average costs and benefits as outlined in the preliminary determination, both nationally and for individual climate zones. The average per-unit incremental cost increases to $7,229 (compared to $5,555 in the preliminary determination) due to the supply chain cost increase factor of 37 percent; however, the increase is moderated by the inclusion of the 5 percent FHA cost reduction factor to reflect the smaller FHA-sized house relative to the larger market as described above. Estimated annual energy savings increases to $963 (compared to $751 in the preliminary determination) due to the energy price increase factor of 32 percent. Net life cycle cost savings become $15,071. With these revisions, simple payback period increases slightly from 7.6 years shown in the preliminary determination to 7.7 years in the final determination. Due to the revised down payment rate of 5 percent reflecting the average FHA borrower's downpayment, years to positive cashflow is reduced to 1.5 years (compared to 2 years in the preliminary determination). Accordingly, HUD and USDA's analysis still demonstrates the affordability of the 2021 IECC.

5. Timeframe of Analysis

One commenter recommended calculating energy cost savings over the economic lifespan of a building, which is 75 years, instead of over a typical 30-year mortgage period, which would show greater energy cost savings.

HUD–USDA Response: HUD and USDA based the lifetime of the investment for the preliminary determination on the typical length of a mortgage, which is 30 years. This is the well-established cost estimate methodology established by DOE in consultation with the ICC and associated stakeholder input. The commenter is correct, and HUD and USDA agree, that these improvements will yield improved home quality and energy efficiency well beyond the 30 years, potentially for the life of the building, but there are no established estimates for accurately or reliably estimating these longer-term benefits. It is also likely that homeowners will upgrade their homes with more efficient equipment or improved building measures such as higher performance windows. While DOE's analysis includes replacement costs over the period of a typical mortgage, estimates of efficiency gains beyond that period are not included in the modeling here.

D. Impact of Manually Operated Bathroom Fans Allowed Under the IECC on Indoor Air Quality and the Health of Occupants

HUD and USDA requested comments on anecdotal reports that because manually operated bathroom fans allowed under the IECC to meet ventilation requirements rely on occupant action to operate them, these may impact indoor air quality and the health of occupants.

There were no comments, supportive or otherwise, that directly addressed the possible health concern caused by the use of manually operated bathroom fans to meet IECC ventilation requirements.

However, several comments were received on moisture management, and ventilation issues. One commenter reiterated the importance of moisture management in energy efficient buildings and recommended the use of energy recovery ventilation (ERV) or heat recovery ventilation (HRV) equipment. Another commenter indicated that ''HUD must ensure that that the benefits of the proposed standards do not come at the expense of resident health,'' noting that updated energy codes require more tightly sealed envelopes that, if not accompanied by appropriate and well-maintained ventilation, may create the risk of moisture retention and mold, accumulation of indoor air pollutants, and other causes of building related illness. The commenter proposed that HUD should ''fully fund and vigorously implement'' time-of-construction inspections to enforce ventilation requirements such as ASHRAE 62.1 and 62.2, as well as on-going NSPIRE inspections.

HUD–USDA Response: HUD and USDA share the commenter's commitment to resident health in energy efficient buildings. The 2021 IECC sets maximum air leakage of 5.0 ACH50 (5 air changes per hour) or 0.28 CFM/sf as measured by a blower door test, or 3.0ACH50 when following prescriptive requirements (allows for 0.30 CFM/sf enclosure area for attached dwelling units and buildings that are 1,500 sf or smaller). The IECC requires compliance with Section M1505 of the International Residential Code (IRC), which sets minimum ventilation rates for whole house ventilation systems as well as local exhaust rates. ASHRAE 90.1 for multifamily buildings references ASHRAE 62.2, Ventilation and Acceptable Indoor Air Quality in residential buildings.

Regarding energy or heat recovery systems, the 2021 IECC requires such systems for Climate Zones 7 and 8 (colder climate zones), but these are optional in other climate zones. Heat Recovery Systems (HRVs) supply continuous fresh air from outside the home and recover between 60–95 percent of heat in exhaust air, thereby contributing significantly to the energy efficiency of a building. Energy Recovery Systems (ERVs) can exchange both heat and moisture, thereby keeping humidity levels relatively stable.

E. Potential Fire Code Issues Associated With Air-Sealing Requirements for Attached Single Family Homes or Low-Rise Multifamily Properties

HUD and USDA asked for comments on potential challenges to meeting both the more stringent air sealing requirements introduced in the 2012 IECC (3 ACH 50 in certain climate zones) as well as fire code specifications in attached row-house, town home or multifamily settings. This had been identified as a possible barrier when 3ACH 50 was originally proposed in the 2012 IECC.

Several commenters indicated that the 2021 IECC air leakage requirements of 3 air changes per hour or 5 air changes per hour at 50 pascals depending on the climate zone should not present fire code issues for single family attached homes or low-rise multifamily properties. Commenters experienced on the issue indicated that they have no knowledge of any challenges meeting the 2021 IECC air leakage requirements and fully complying with the fire code. One commenter included that 28 states and more localities have implemented the code without any fire code issues. Another commenter stated that technologies exist to comply with air leakage and fire code requirements without challenges.

HUD–USDA Response: Air sealing of area separation wall assemblies in multifamily buildings had been identified by DOE and others as a barrier that limits the ability of builders to cost effectively achieve higher energy efficiency and quality levels in multifamily housing.[60]

Air leakage through these assemblies could also be a barrier to achieving air leakage limits mandated by the IRC and IECC. More specifically, fire blocking sealants approved for use to seal framing penetrations within a dwelling are not allowed to be used to seal the perimeter of ¾ inch air space required in UL 263 (also ASTM E119) area separation walls. This unsealed perimeter condition makes these walls porous to airflow coming from the exterior or from attached garages.

Training materials from the Energy Efficient Building Association (EEBA) also indicate that the 3 ACH 50 air sealing requirement may be a challenging target for townhomes or where there are common walls between units, and that there is a lack of clarity in how to air seal the wall between these units without violating the fire-rated assembly.[61] EEBA indicated that there have been some breakthroughs recently with retesting fire-rated wall assemblies with specific foams and sealants to show that they will perform, and several options are now listed in the UL database. Based on the comments received, this issue seems to have been resolved.

F. Time Required for Builders and Building Designers To Familiarize Themselves With the New Codes and Training or Technical Support That May Be Required

HUD and USDA requested comments on the time required for builders and building designers to familiarize themselves with the new codes, the training or technical support that may be required by building professionals and local code officials on the new requirements of the 2021 IECC and ASHRAE 90.1–2019 standards, workforce training needs, and any other issues related to implementation of these standards. Comments on particular challenges or issues facing rural areas in adoption and/or implementation of these codes were also requested.

1. Implementation Timeline

Several commenters indicated that HUD and USDA should implement the new 2021 IECC and ASHRAE 90.1–2019 standards in a way that accommodates time requirements, training and technical support requirements, and other issues necessary for builders and building designers to meet the new codes.

One commenter noted that implementation of these standards has already begun in certain states and localities. One commenter suggested that the implementation timeline should align with state activities and federal incentives to best ensure the intended benefits are achieved. Another commenter suggested that an implementation timeline of at least two years be adopted to enable builders and code enforcement officials to become familiar with the new standards.

Some of the commenters suggested approaches to most easily support the implementation of the 2021 IECC and ASHRAE 90.1–2019 standards. Several commenters advised HUD and USDA to recognize and consider key market dynamics, including supply chain issues and contractor education and training in the development of an implementation timeline. One commenter suggested that HUD and USDA should clarify compliance requirements for builders and conduct training for builders, developers, designers, and construction workers on the new codes.

[60] Department of Energy, *Building America Expert Meeting: Code Challenges with Multifamily Area Separation Walls, 2015.*

[61] Energy Efficient Building Association (EEBA), Air Sealing Requirements for IECC 2021 with Building Code Expert Joe Nebbia; Excerpts from Module 6 of an 8-Part IECC 2021 Code Series, *https://www.eeba.org/air-sealing-requirements-for-iecc-2021-with-building-code-expert-joe-nebbia.*

One commenter suggested that extending the implementation timeline, particularly for FHA-insured and USDA-guaranteed loans, would improve the implementation process of the new requirements. The commenter stated that such an extension may be necessary to align the proposed HUD and USDA requirements with the Inflation Reduction Act section 50131 funding, which serves to assist jurisdictions in the adoption and effective implementation of energy codes that meet or exceed the 2021 IECC.

HUD–USDA Response: HUD and USDA agree that the implementation time period for new editions of the codes needs to have some flexibility to allow for proper training and education of builders on the requirements of the most recent editions of the IECC and ASHRAE 90.1. Note, however, such training is already offered by, for example, the Regional Energy Efficiency Organizations (REEOs), such as SPEER in Texas and Oklahoma, and there are already builders that are using these codes. Some states have also already required them or exceeded them. In addition, DOE is offering new funding for energy codes training for the building industry, states, and local municipalities.

HUD and USDA also agree that alignment with existing or new sources of funding that can assist in the effective implementation of the energy codes will be useful. This transition will have some learning curves. The agencies anticipate gradual adoption beginning for some programs at the publication of this notice and full implementation within all programs covered by this final notice by the date of January 1, 2025, or later for certain programs.

HUD and USDA also agree that there is a need to align federal incentives that can assist builders to become trained in these codes. HUD and USDA are working with DOE and the states to leverage the unprecedented levels of funding through the Bipartisan Infrastructure Law (BIL) and Inflation Reduction Act (IRA) to support builders and developers in complying with the 2021 IECC and ASHRAE 90.1–2019 standards proposed in this notice. This funding includes $225 million in BIL funding for state agencies to partner with key stakeholders, such as local building code agencies, codes and standards developers, and associations of builders and design and construction professionals to update their building codes. In addition, another $1 billion in IRA funds is available to support states, territories, and jurisdictions with the authority to adopt energy codes in adopting and implementing the latest energy codes and zero energy codes.

DOE has already released funding in advance of this notice to support the training of builders in these codes. As part of the $225 million in BIL funding, DOE announced $90 million as Resilient and Efficient Codes Implementation (RECI) competitive grant awards in July 2023 to help states and partnering organizations implement updated building energy codes. This funding is the first installment of a 5-year program established to support building energy code adoption, training, and technical assistance at the state and local levels. Twenty-seven awards were made in 26 states.[62] In addition, in September 2023 DOE announced another $400 million in IRA formula funds to the states to implement energy codes; $240 million will be available to adopt and implement the latest building energy code, the 2021 IECC for residential buildings and ANSI/ASHRAE/IES Standard 90.1–2019 for commercial buildings, or other codes that achieve equivalent or greater energy savings.[63] HUD and USDA will work with DOE and its grant recipients to leverage technical assistance and training for builders, developers, and others involved in building HUD- and USDA-financed housing.

In addition to the BIL and IRA funds awarded to states to advance adoption of more current energy codes, including the 2021 IECC and zero energy codes, HUD and USDA anticipate a significant increase in the number of new homes certifying to Energy Star New Home or ZERH standards as builders take advantage of the Section 45L tax credits of up to $2,500 and $5,000 that are now available to build to these standards. Building to these standards will automatically comply with 2021 IECC requirements. For multifamily, tax credits of up to $2,500 per unit for Energy Star Multifamily New Construction and up to $5,000 per unit for DOE Zero Energy Ready Homes for multifamily homes are now available as well, when builders comply with prevailing wage requirements.

Some affordable housing builders of rental housing are already building to higher energy standards as required by state, federal, or local affordable housing funding streams. A significant driver of affordable housing is the Low-Income Housing Tax Credit, administered by the states. Some states set their energy requirements to exceed prevailing state codes in their Qualified Allocation Plans (QAPs); housing developers who take advantage of such funding are already well versed in meeting higher level energy codes than the baseline.

Regarding comments that HUD and USDA should align its implementation timeline requirements with state code adoption timetables, states follow a wide range of schedules and procedures when considering adoption of the new editions of the codes. States adopt building codes on their own timelines, with some achieving or exceeding the code levels of energy efficiency and others not adopting any code at all. The statutory requirement governing this notice does not provide for HUD and USDA adoption of prevailing state standards but sets the 2021 IECC and ASHRAE 90.1–2019 as published by the relevant code bodies as the required standard for the covered programs.

2. Need for Training and Technical Assistance

Several commenters stated the need for training on the 2021 IECC and ASHRAE 90.1–2019 standards to limit the potential gap between the efficiency levels required in the standards and the efficiency levels achieved in the field. One commenter stated that a lack of training can result in poor implementation of the code and cause unintended building performance and compliance issues.

One commenter referenced a DOE study that found proper training for code officials and the construction community can reduce energy costs by an average of 45 percent due to varying levels of compliance with the codes. Another commenter suggested that HUD and USDA provide free code books and workbooks as part of the training and technical assistance for builders and building designers to alleviate the cost concerns related to training materials and resources. One commenter suggested that HUD and USDA should offer a comprehensive, no-cost training program to ensure equal access to the material necessary to comply with the new standards. The commenter also suggested that the Federal government should cover the cost of any technical training or equipment necessary for nonprofit housing developers to meet the new standards.

HUD–USDA Response: As with any code update, training is indeed an important issue, particularly for changes that include fundamental changes in technology, materials, or practices. In

[62] *https://www.energy.gov/articles/biden-harris-administration-announces-90-million-support-resilient-and-efficient-building.*

[63] $160 million will be available to adopt and implement the zero energy provisions in the 2021 IECC, or other codes with equivalent or greater energy savings. *https://www.energy.gov/articles/biden-harris-administration-announces-400-million-states-improve-building-energy.*

updating to the 2021 standard, the primary focal points will be wall insulation, mechanical systems, and envelope air tightness. Due to the outdated nature of the 2009 IECC, many of these transitions and practices are already happening across the country. Recent energy code field studies, including those conducted by DOE in the 2014 through 2023 timeframe, indicate that higher insulation values, better windows, more advanced mechanicals, and tighter envelopes are already commonplace due to natural market forces and advancements in building products.

Even with this being the case, HUD and USDA will develop training materials and offer training to builders, developers, and lenders through guidance materials and webinars to support the implementation of these new standards, as described in detail in section A.2. above.

3. Enforcement and Compliance

Several commenters emphasized the need to prioritize enforcement of the standards upon enacting the new requirement to ensure the new requirements are being met. One commenter suggested allowing builders to demonstrate compliance through DOE's REScheck code compliance tool. One commenter suggested that HUD and USDA should ensure ventilation maintenance meets the higher standard required in tightly sealed buildings. One commenter suggested that HUD and USDA provide technical assistance to state and local officials to support enforcement. One commenter suggested that HUD and USDA should conduct a post-implementation study to assess compliance and enforcement over the first one to two years of the new requirements.

HUD–USDA Response: HUD and USDA agree that enforcement of the standards will be important in ensuring compliance with the standard. The agencies are anticipated to rely on self-certification that builders and developers will comply with the code requirements specified in this notice. For single family FHA-insured properties, FHA employs self-certification requirements for many of their policies and program requirements and may pursue enforcement for any false claims or false statements made. Enforcement can include criminal penalties, civil penalties, or both.

For FHA single family new construction, in HUD–92541, HUD already requires the builder to certify that the new construction meets or exceeds the 2009 IECC; this certification will be updated for the 2021 IECC.[64] HUD will update the Minimum Property Standards referenced in HUD–92544 with a conforming amendment to align with the requirements of this notice; HUD is the final adjudicator of whether a defect exists and whether the remedy is required.[65]

Certainly, REScheck is a tool that can be used to demonstrate compliance; it is a DOE-supported tool for builders, designers, and contractors to quickly and easily determine whether new homes, additions, and alterations meet the requirements of the IECC or a number of state energy codes. REScheck also simplifies compliance determinations for building officials, plan checkers, and inspectors by allowing them to quickly determine if a low-rise residence meets the code.

Note that REScheck is set up for building envelope-related insulation and window trade-off calculations in residential single family and low-rise multifamily buildings only; it is not used for the IECC performance path, which relies on other energy modeling tools, *e.g.,* HERS or IC3. REScheck works by performing a simple U-factor x Area (UA) calculation for each building assembly to determine the overall UA of a building. The UA that would result from a building conforming to the code requirements is compared to the UA for the building constructed. If the total heat loss (represented as a UA) through the envelope of a building does not exceed the total heat loss from the same building conforming to the code, the software generates a report that declares the building is compliant with the code.

G. Impact and Duration of COVID-Related Supply Chain Challenges for Certain Products and Materials, Particularly But Not Exclusively for Lumber Products

HUD and USDA's preliminary determination acknowledged the construction industry's experience with COVID-related supply chain challenges for certain products and materials, particularly but not exclusively for lumber products, leading to significant price increases in such products as framing lumber, plywood, and oriented strand board (OSB). The agencies solicited comments on the duration, persistence and intensity of these price increases, the extent to which they may impact the cost of energy related products or materials covered by the IECC or ASHRAE 90.1 energy codes addressed in this notice, and to what extent these supply chain issues may impact implementation of the codes addressed by this notice.

One commenter affirmed the insulation industry's ability to meet any increase in demand as a result of requiring the 2021 IECC and ASHRAE 90.1–2019 standards.

Two commenters expressed concern for the construction industry's ability to meet the additional demand caused by HUD and USDA's requirement of the 2021 IECC and ASHRAE 90.1–2019 standards. A commenter stated that additional code requirements will exacerbate the existing stresses for homebuyers and developers, which include market scarcity, rising prices, high interest rates, increased construction costs, labor shortages, and limited subsidies.

One commenter stated their concern with construction costs continuing to rise which impacts affordability on top of supply shortages for required materials such as windows, insulation, and other components. The commenter highlighted the fact that HUD's National Housing Market Summary for the first quarter of 2023 indicated that rising construction costs are expected to have an ongoing impact on the affordability of rental housing. Another commenter suggested that the agencies create a right of review on a case-by-case basis for builders unable to source required building materials.

HUD–USDA Response: HUD and USDA recognize that there were significant cost increases in certain construction materials resulting from specific COVID-related supply chain shortages, as well as inflation. The agencies have included a construction cost increase using the Bureau of Labor Statistics Producer Price Index (PPI) of 37 percent, as cited by the NAHB.[66] [67] This reflects cost increases for residential construction during the 2020–23 period. While this additional cost increase adds to the initial first cost of complying with the 2021 IECC, this does not impact the overall affordability of the investment, as shown in Tables 13–16 of this final determination.

With regard to material shortages including windows and insulation and

[64] HUD Builder Certification, *https://www.hud.gov/sites/dfiles/OCHCO/documents/92541.pdf.*

[65] *https://www.hud.gov/sites/dfiles/OCHCO/documents/92544.pdf.*

[66] BLS, Producer Price Index Commodity Data, One-Screen Data Search, *https://data.bls.gov/PDQWeb/wp.* [Under Select a Group, select ''IP Inputs to industries''; under Select one or more Items, select ''IP23110013 Inputs to residential construction, goods less foods and energy.''

[67] Building Materials Prices Fall for Second Month Straight, Eye On Housing, *https://eyeonhousing.org/2023/06/building-materials-prices-fall-for-second-month-straight/.*

their potential impact on builders' ability to comply with the latest editions of the codes, HUD and USDA recognize that some materials may be in short supply and may cause construction delays, but have been unable to determine the scale and scope of such shortages nationwide. In addition, the 2021 IECC and ASHRAE 90.1–2019 do not require specialized materials that are not already required for previous editions. According to one recent report, the hardest insulation material to procure has been polyiso insulation, a closed-cell, rigid foam board typically used for roofing—as a result of 2021's winter storm Uri that disrupted the supply chain of MDI, one of the raw materials that goes into polyiso insulation material.[68] That resulted in a shortage of insulation materials starting in February 2021. In other parts of the country, COVID–19 and transportation issues strained supply. However, the report cites industry sources report that lead times for items like fiberglass insulation and spray foam insulation have improved in recent months.

HUD and USDA recognize that shortages may arise as a result of COVID–19 supply chain issues. If shortages arise that prevent builders from meeting the IECC 2021 and ASHRAE 90.1–2019 requirements, builders should contact HUD or USDA with information on the product shortage. HUD and USDA will consider alternate materials based on the agencies' review of available materials. In addition, HUD and USDA will publish a list of possible material shortages and provide options for builders to comply with the codes.

H. Alignment With Green Building Standards and Alternate Compliance Paths

The preliminary determination noted that HUD and USDA currently provide incentives or require green building standards for some programs and their interest in maximizing alignment between the 2021 IECC and ASHRAE 90.1–2019 and these green building standards. Recognizing that there might be a lag time between the publication of the current editions of the IECC and ASHRAE 90.1 and their incorporation in these green building standards, the agencies requested comments on the current minimum IECC and ASHRAE 90.1 requirements in these standards, and/or the timetable for adopting the 2021 IECC and ASHRAE 90.1–2019 as baseline requirements.

One comment was received on the specific question of the baseline energy code established in third-party green building standards but several comments were submitted as to how these or other standards could be used as alternative compliance paths for the 2021 IECC and ASHRAE 90.1–2019 requirements of this notice. Several commenters who expressed their support for the preliminary determination provided suggestions for certification alternatives to meet the 2021 IECC and ASHRAE 90.1–2019 standards. One commenter emphasized that any alternative compliance pathways must enforce equivalent building envelope standards to those required by the 2021 IECC and ASHRAE 90.1–2019. One commenter stated that third-party certifications are an essential part of expanding access to HUD and USDA financing in markets where there may be a lack of certified inspectors or inspectors who are trained on an amended energy code that does not meet the program requirements.

1. Alternative Compliance Pathways

One commenter stated that third-party certifications are an essential part of expanding access to HUD and USDA financing in markets where there may be a lack of certified inspectors or inspectors who are trained on an amended energy code that does not meet the program requirements. Several commenters proposed that HUD and USDA accept specific green building or energy code standards. One commenter proposed an alternative compliance pathway of ENERGY STAR v3.1.

One commenter suggested HUD and USDA accept the following as alternative compliance pathways: ENERGY STAR Certified Homes, DOE Zero Energy Ready Homes, ANSI/RESNET/ICC standard 301, Enterprise Green Communities, ENERGY STAR Indoor Air Plus, LEED, Living Building Challenge, and Passive House. Multiple commenters proposed an alternative compliance pathway of the National Green Building Standards.

One commenter suggested HUD and USDA recognize the Home Energy Rating System (HERS) Index as an alternative compliance pathway. The commenter suggested adopting a threshold of a HERS Index Score of either 60, as used by Freddie Mac for their Single Family Green Mortgage-Backed Securities program, or 57 as the equivalent index to IECC 2021. Another commenter proposed an alternative compliance pathway of a HERS Index Score of 57 or lower.

One commenter suggested that HUD and USDA accept third-party energy and green building certifications as alternative energy compliance methods. Two commenters suggested that HUD and USDA move towards the adoption of an all-electric new construction standard to achieve zero carbon new homes for low- and moderate-income communities. The commenter suggested the adoption of the optional zero-emissions and zero-energy appendices of the 2024 IECC and adapt the appendixes for ASHRAE 90.1–2022.

One commenter suggested that HUD and USDA offer the ASHRAE 90.2–2018 standard as an alternative compliance pathway to the 2021 IECC standard as it provides more flexibility to satisfy local conditions and costs while delivering residential building energy performance that is approximately 50 percent less consumptive than the 2006 IECC standard and approximately 20 percent more energy efficient than the 2021 IECC standard.

HUD–USDA Response: HUD and USDA appreciate the range of recommendations for alternative compliance pathways suggested by the commenters. Most of these pathways conform to the requirements of meeting and exceeding the 2021 IECC and ASHRAE 90.1–2019. These are discussed below:

• *HERS Ratings.* With regard to the proposal to accept the HERS rating as an acceptable alternative, HUD and USDA recognize the important role that the HERS Index plays in rating new homes in the U.S. A recent RESNET report shows that 330,000 homes received a HERS rating in 2022. The commenter recommending adoption of the HERS Index pointed to two states, Massachusetts and Texas, that have adopted the HERS Index as an alternate compliance path. Texas has adopted a sliding scale for the HERS Index with graduated increases in efficiency from 2022 to 2028, with a HERS Index of 55–59 required after 2028 for Climate Zones 2,3,4. These scores are above (*i.e.,* less efficient than) the 2021 IECC ERI scores of 51–54 for these zones. Massachusetts, on the other hand, set the required HERS rating at 52, the same as the 2021 IECC.

These alternative HERS ratings do not include the mandatory requirements of the 2021 IECC; accordingly, HUD and USDA are not in a position to accept a HERS rating as an alternative to the 2021 IECC but do recognize the growing importance of this rating as a means to communicate energy performance better to homebuyers and encourage its use by builders. The HERS rating is also an integral part of the two federal above-

[68] Construction Dive, Construction's supply chain outlook: more shortages, price hikes ahead, November 2022 *https://www.constructiondive.com/news/supply-chain-construction-building-materials-price-2023/636442/.*

code standards of EPA's Energy Star for Homes and DOE's Zero Energy Ready Homes, which can earn the 45L tax credit of $2,500 and $5,000 respectively.

• *Zero Energy or Zero Energy Ready standards:* HUD and USDA are aware of the voluntary IECC zero emission appendix and the new zero energy appendix to ASHRAE 90.1–2022. While the statute that governs this notice does not allow the agencies to require an above-code zero energy standard or zero energy ready standard without an affordability or availability determination, the agencies encourage builders to consider building to the standards outlined in these appendices as published by the ICC and ASHRAE respectively. Adoption of the appendices is at the builder or developer's discretion.

Additionally, there are IRA funds that support solar and renewable energy installations including the Greenhouse Gas Reduction Fund and solar and renewable energy tax credits, which are refundable and offer greater incentives for low-income communities. HUD and USDA encourage builders to explore ways to utilize this financing to build zero energy homes that will, by lowering energy expenditures, assist homebuyers in achieving long-term homeowner financial sustainability.

• *Energy Star for New Construction.* Energy Star Version 3.1, the prevailing version of the standard that is nationally required by EPA as of January 2023, has been modeled to exceed the 2015–2018 IECC by approximately 10 percent, which on an overall performance basis is likely to be equivalent or equal to the 2021 IECC. However, the absence of specific thermal backstop requirements specified in the 2021 IECC excludes Version 3.1 from serving as a compliance pathway for the 2021 ICC. Version 3.2, however, takes effect January 2025, and will be accepted by HUD and USDA as an alternate compliance path. Similarly, Energy Star for Multifamily New Construction Version 1.2 will be accepted as an alternate compliance path.

• *DOE Zero Energy Ready Homes Program.* The DOE Zero Energy Ready Homes Program sets rigorous efficiency and performance criteria, with certified homes capable of offsetting most or all of the home's annual energy use through a renewable energy system. Single family homes must achieve Single Family Version 2 certification to be accepted as an alternate compliance path. Multifamily homes must achieve Multifamily Version 2 certification, which will be released on January 1, 2025, to be accepted as an alternate compliance path.

• *Green Building Standards.* As noted in the preliminary determination, HUD specifies a range of green building certifications through a range of programs, either as an incentive (the Green Mortgage Insurance Premium) or as a requirement (CDBG–DR). HUD and USDA will accept a Green Building Certification as a compliance pathway upon submission and approval by the agencies of evidence that the 2021 IECC and ASHRAE 90.1–2019; Energy Star Single Family New Construction Version 3.2 certification or Version 1.2 for Multifamily New Construction certification; or DOE Zero Energy Ready Homes Single Family Version 2 or, once released, Multifamily Version 2 have been established as minimum requirements.

2. Promoting Unvented Attic Spaces

Several commenters suggested HUD and USDA allow for the use of unvented attics, which provide builders with additional flexibility by enabling insulation with lower R-values and eliminating thermal losses from ductwork in unconditioned attic spaces. Two of these commenters suggested that HUD and USDA adopt the International Residential Building Code (IRC), which would replace existing references to the 1994 CABO Code and enable the use of unvented attics.

One commenter suggested that to promote the use of unvented attics, HUD and USDA adopt an alternative compliance pathway for insulating attics. The commenter suggested an alternative standard for unvented attics and enclosed rafter assemblies. This included lowering R values for ceiling insulation in Climate Zones 1–3 to R–22 and in Climate Zones 4–8 to R–26, requiring blower door tests results of less than 3.0 ACH50 for all climate zones, and other measures.

HUD–USDA Response: While significant efficiency gains can be achieved by locating all heating and cooling equipment in a property's conditioned space and providing for unvented attic space, the specific proposal recommended by the commenter would lower ceiling/roof insulation levels below those specified in the 2021 IECC and therefore cannot be accepted as part of the HUD and USDA determination. The agencies are not able to adopt amendments to the 2021 IECC and must establish the standard in full as is required by the statute.

Note that the reference by the commenter to the 1994 CABO is assumed to reference outdated code citations that have not been updated in HUD regulations; HUD anticipates removing any references to outdated codes in its regulations as part of its implementation of this standard.

3. Alignment With Existing State or Local Codes

One commenter suggested that HUD and USDA take local and state requirements into consideration when finalizing code requirements at the national level. Two comments were received on how the HUD and USDA requirements would align with adoption by states of the 2021 IECC with amendments. One commenter suggested that HUD and USDA accept the IECC code version adopted by the state where a project is located instead of requiring the 2021 IECC. Another commenter stated their concern that implementation of this proposed rule would leave many jurisdictions out of HUD and USDA programs, including three states that have adopted the 2021 IECC with amendments and would not be in compliance with this requirement.

HUD–USDA Response: HUD and USDA recognize that states considering IECC adoption may do so with either weakening or strengthening amendments. DOE's State Portal analyzes the impact of any amendments to the site energy index for the energy code adopted by each state. For example, Idaho adopted the 2018 IECC with amendments and DOE found these amendments to reduce the efficiency of the 2018 IECC to more closely resemble the 2009 IECC.

As of December 2023, 42 states and the District of Columbia have adopted some version of the IECC. Of these states, 33 have adopted the IECC with amendments. According to DOE's analysis, 24 of these amendments weaken the efficiency of the code, five do not substantially alter the efficiency of the code, and four improve the efficiency of the code.[69]

Of the 22 states that are shown by DOE to have adopted the 2009 IECC or its equivalent due to weakening amendments, two states have adopted the 2012 IECC with weakening amendments, six states have adopted the 2015 IECC with weakening amendments, nine states have adopted the 2018 IECC with weakening amendments, and one state have adopted the 2021 IECC with amendments that have been determined by DOE to be equivalent to a weaker code. The governing EISA-amended Cranston Gonzalez statute does not provide for the flexibility of amending

[69] State Portal, Building Energy Codes Program, *https://www.energycodes.gov/state-portal.* Based on update from 09/29/2023.

either code; the statute requires that all housing specified in the statute ''meet the requirements of the revised code or standard''. (42 U.S.C. 12709(d)). HUD and USDA recognize that many states adopted the codes with amendments; however, these amendments often impact the energy efficiency of the code. To comply with the final determination, all impacted HUD and USDA housing must meet or exceed the energy efficiency of the 2021 IECC or ASHRAE 90.1–2019 regardless of any amendments adopted to the code at the state level.

HUD and USDA acknowledge that the code adoption landscape has changed and will continue to change ahead of the final determination going into effect. Since the drafting of the preliminary determination, two states, Connecticut and New Jersey, have adopted the 2021 IECC as the state requirement. With this in mind, the estimated 150,000 single family homes and low-rise multifamily units and 16,550 high-rise multifamily units affected by this notice represents the approximate number of impacted homes based on average annual production from 2019 to 2021.

4. Proposed Alternative Prescriptive and Performance Compliance Pathways

One commenter proposed an alternative prescriptive compliance path framework. This alternative compliance path involves integrating the expected 2024 IECC ceiling insulation and wall insulation requirements into the 2021 IECC, as well as a credit system for prescriptive measures similar to that proposed for the 2024 IECC. The same commenter also proposed an alternative performance compliance framework for energy modeling software developers.

HUD–USDA Response: The commenter is proposing an approach that is not applicable for including in a federal determination. These amendments are more relevant to the code development process, which has been discussed in the 2021 and 2024 energy code update cycle, rather than the code adoption process.

The EISA statute requires HUD and USDA to adopt the code in full, meaning that the preliminary determination is not an opportunity to reevaluate the code package itself. HUD and USDA cannot specify an alternative code that deviates from the published and consensus-based model energy code, which has gone through a rigorous affordability and availability analysis in preparation for its proposed adoption. Both the proposed prescriptive and performance compliance path frameworks envision modifications to the 2021 IECC that have been proposed or adopted for the 2024 IECC, *e.g.,* realignment of ceiling and wall insulation requirements (Prescriptive Framework proposal 2), establishing requirements for energy modeling software for envelope backstops (Performance Framework proposal 3).

Once the 2024 IECC is published, it can serve as a viable alternative to the 2021 IECC for states who choose to adopt the new code as has been the case for states that have adopted versions beyond the 2009 IECC over the past decade. The proposed changes would require modifying the 2021 IECC in a manner that is inappropriate for this technical review of the 2021 IECC and ASHRAE 90.1–2019 standards. In addition, changes resulting from these proposed modifications to the modeling software would likely result in modifications to the requirements of the 2021 IECC; modifications to the 2021 IECC are beyond the scope of the statutory requirements that govern this notice. HUD has provided DOE with the performance modeling framework proposals for consideration in future code modeling.

I. Additional Comments

1. Veterans Administration Enhanced Loan Underwriting Methods

One commenter suggested that HUD and USDA add a provision for the recently enacted Department of Veterans Affairs (VA) enhanced loan underwriting methods to FHA and USDA mortgages.

HUD–USDA Response: This comment references recently enacted legislation requiring the VA to incorporate energy expenditures when underwriting VA loans (Consolidated Appropriations Act of 2023, Section 203. Enhanced Underwriting Methods (Pub. L. 117–238). While the legislation does not specify methodology for addressing energy efficiency, it will incorporate household energy expenditures into the Principal Interest Taxes Insurance (PITI) calculation. This is beyond the scope of this notice, which does not address underwriting methods. The agencies will track the VA initiative for lessons learned and applicability to HUD and USDA programs.

2. Incorrect Montana Data

One commenter suggested that the data utilized in the preliminary determination to produce the energy cost savings and financial impacts incorrectly utilized the 2009 IECC for the State of Montana instead of the 2021 IECC, which Montana adopted with exceptions for cost-prohibitive requirements based on state-specific variables and climate requirements in June 2022.

HUD–USDA Response: As noted in the preliminary determination, HUD and USDA use DOE–PNNL assessments of the effective or equivalent code adopted by a state after weakening amendments. In Montana's case, the state adopted the 2021 IECC with amendments that reduce the overall energy efficiency of the code by 10.4 percent. As such, DOE has determined that Montana's code functionally resembles the 2009 IECC.[70]

3. Inclusion of Greenhouse Gas Emissions

One commenter suggested that the RIA and the final determination should not consider the external social value of reducing emissions of greenhouse gases because the statute does not require its consideration. In contrast, another commenter suggested that the preliminary determination may understate the benefits associated with updating minimum efficiency requirements by not quantifying the non-energy benefits from improved efficiency as well as the total emissions reductions.

HUD–USDA Response. Pursuant to OMB requirements, the RIA includes estimated reduction of carbon emissions and associated savings in the social cost of carbon. However, HUD and USDA agree that the social impact of reducing carbon emissions is not relevant to the consumer affordability analysis required by the statute. The inclusion of these costs in the RIA is used to determine the larger benefits of this regulatory action, but they are not taken into account when considering the affordability and availability of the impacted housing.

4. Covered Housing vs. Existing Housing Stock

One commenter stated that the statute specifically requires HUD and USDA to make a determination that the revised codes do not negatively affect the availability or affordability of new construction, indicating that the availability of new construction specifically needs to be the point of analysis instead of the overall availability of the existing housing stock. This commenter stated that this is particularly important due to the outsized role new homes play in the current market, making up 31 percent of the housing stock.

HUD–USDA Response: With regard to considering the ''overall availability'' of the existing housing stock, it is not clear

[70] State Portal, Building Energy Codes Program, *https://www.energycodes.gov/state-portal.*

what item in the RIA or preliminary determination the commenter is referring to; both the RIA and the preliminary determination focused on the impact that this notice would have on the supply/production of new USDA–HUD financed housing, not on the availability of housing outside this stock.

The RIA does acknowledge purchase of an existing home as an alternative option; however, the availability analysis focuses on impacts to new construction as per the statute. As part of the analysis, it takes into account the broader economic impacts of the proposed standards. This perspective is included to demonstrate the substitutes available to buyers in the real world; however, existing homes are not considered as a central part of the availability analysis. HUD and USDA have modified the RIA.

5. Impact on Increased Sprawl

One commenter suggested that the preliminary determination does not accurately account for the potential increase in urban sprawl, which would increase travel-associated greenhouse gas emissions.

HUD–USDA Response: The commenter raises an important point regarding carbon emissions and the built environment: siting and location of housing will impact transportation carbon emissions, as discussed in the National Transportation Decarbonization Blueprint. Siting housing near transportation options or adjacent to schools, employment, services, and amenities will significantly lower Vehicle Miles Traveled (VMTs) and associated carbon emissions. However, this is outside the scope of this notice.

III. Final Determination—2021 IECC

A. Overview

The IECC is a model energy code developed by the International Code Council (ICC) through a public hearing process involving national experts for single family and low-rise residential buildings as well as commercial buildings.[71] The code contains minimum energy efficiency provisions for residential buildings, defined as single family homes and low-rise multifamily buildings (up to three stories). The code offers both prescriptive and performance-based approaches. The efficiency standards associated with the IECC set benchmarks for a structure's walls, floors, ceilings, lighting, windows, doors, duct leakage, and air leakage.

Revised editions of the IECC are typically published every three years. Full editions of its predecessor, the Model Energy Code, were first published in 1989, and new editions of the IECC were published every three years beginning in 1998. The residential portion of the IECC was heavily revised in 2004: the Climate Zones were completely revised (reduced from 17 Zones to the current eight primary Zones) and the building envelope requirements were restructured into a different format.[72] The post-2004 code became much more concise and simpler to use, but these changes complicate comparisons of State codes based on pre-2004 versions of the IECC to the more recent editions.

For single family housing, the IECC is one component of the larger International Residential Code (IRC). Each version of the IRC, beginning with the 2015 edition, has the corresponding version of the IECC embedded directly into that code (Chapter 11). A majority of states have adopted some version of the IRC. For other building types, including multifamily housing, the equivalent building code is the International Building Code (IBC), which also refers to other codes such as the International Plumbing Code, the International Electrical Code or, in this case, the IECC. Those codes also then embody or refer to other codes in the industry, such as ASHRAE 90.1. In this hub and spoke model, there is even more differentiation between states regarding which versions of which codes are adopted as a suite of codes at any given point in time. Even with the adoption of the IRC, the all-in-one code that is focused on single family housing, states and local areas sometimes make adjustments to the code, removing and in some cases adding requirements for some building elements.

1. Current HUD–USDA Standard and Subsequent Revisions

In May 2015, HUD and USDA published a Final Determination that established the 2009 IECC as the minimum standard for both new single family housing built with HUD and USDA assistance and new HUD-assisted or FHA-insured low-rise multifamily housing.[73] HUD and USDA estimated that 3,200 multifamily units and 15,000 single family units per year could potentially be impacted in the 16 states that had not yet adopted either of these codes. The average incremental cost of the higher standard was estimated to be $1,019 per unit, with average annual savings of $215, for a 5-year payback and a 1.3-year net positive cash flow. HUD and USDA determined that adoption of the 2009 IECC would not negatively impact the affordability and availability of the covered housing. The 2009 IECC represented a significant increase in energy efficiency of 7.9 percent and a 10.8 percent cost savings over the previous (2006) code.

Since HUD and USDA's adoption of the 2009 IECC, there have been four revisions to the IECC.[74] No action was taken by the prior Administration to comply with the statutory requirements to consider or adopt these updated codes.

The figure below shows the average national energy cost savings estimated with each version of the IECC. The greatest incremental savings come from the 2012 IECC (23.9 percent), followed by the 2009 IECC (10.8 percent over the 2006 IECC), followed by the 2021 IECC (8.7 percent). PNNL provided HUD with cost and benefit estimates for adopting the 2021 IECC from a baseline of the 2009 IECC and has made publicly available estimates for adopting the 2021 IECC from a 2018 IECC baseline. For states that have adopted standards equivalent to the 2012 or 2015 IECC, HUD and USDA use the estimates for the adoption from the 2018 to the 2021 IECC, as the 2012 and 2015 IECC both are closer to the 2018 IECC than the 2009 IECC.

[71] The IECC covers both residential and commercial buildings. States that adopt the IECC (or portions thereof) may choose to adopt the IECC for residential buildings only or may extend the code to commercial buildings (which include multifamily residential buildings of four or more stories). Chapter 4 of the IECC Commercial Code allows compliance with ASHRAE 90.1 as an optional compliance path.

[72] In the early 2000s, researchers at the U.S. Department of Energy's Pacific Northwest National Laboratory prepared a simplified map of U.S. climate zones. The map was based on analysis of the 4,775 U.S. weather sites identified by the National Oceanic and Atmospheric Administration, as well as widely accepted classifications of world climates that have been applied in a variety of different disciplines. This PNNL-developed map divided the United States into eight temperature-oriented climate zones. See *https://www1.eere.energy.gov/buildings/publications/pdfs/building_america/4_3a_ba_innov_buildingscienceclimatemaps_011713.pdf.*

[73] 80 FR 25901 (May 6, 2015).

[74] IECC 2012, 2015, 2018, and 2021.

Table 10. Incremental Energy Savings Associated with Each IECC Version – 2006 to 2021[75]

Year of code	Comparison year	National weighted energy cost savings (%)
2009	2006	10.8
2012	2009	23.9
2015	2012	0.7
2018	2015	2.0
2021	2018	8.7

Each successor edition since the 2009 IECC has increased energy efficiency and offered cost savings to consumers in varying degrees:

(1) The 2012 IECC was published in May 2011, representing a significant increase of 23.9 percent in energy cost savings over the 2009 IECC.[76] [77] Key changes in the 2012 edition included: increased stringency for opaque thermal envelope components; clarification that sun rooms enclosing conditioned spaces must meet the thermal envelope provisions; requirements for a blower door test to determine the air leakage rate and limits for the number of prescribed air changes per hour (ACH) per climate zone; insulation to at least R–3 for hot water piping; and an increase in the minimum number of high-efficacy electrical lighting sources from 50 percent to 75 percent of permanent fixtures or lamps in permanent fixtures.[78] [79] This translated into an estimated $500 or 32.1 percent annual cost savings per unit over the 2006 IECC.[80]

(2) The 2015 IECC was substantially the same as the 2012 edition, with a modest increase in energy efficiency of just 0.87 percent over the 2012 IECC.[81] Revisions in this edition included: revised provisions for existing buildings; removal of exemption for historic buildings; revised requirements for building envelope and duct leakage testing and hot water distribution efficiency. The most notable innovation was the introduction of a new Energy Rating Index (ERI) performance path that utilizes the Home Energy Rating System (HERS) Index.

(3) The 2018 IECC also saw limited changes to the prior edition. In its efficiency determination for the 2018 IECC, DOE found site energy savings over the prior code of just 1.68 percent; 1.91 percent source energy savings; and 1.97 percent annual energy cost savings.[82] Of the 47 changes in this edition, most were expected to have a neutral impact on energy efficiency, with two changes making up most of the energy savings associated with the updated code: (1) lower fenestration U-factors in Climate Zones 3 through 8, and (2) an increase in high-efficacy lighting from 75 percent to 90 percent of permanently installed fixtures in all climate zones.

2. 2021 IECC—Overview

As required by statute, this notice addresses the most recent edition of the IECC, the 2021 IECC.[83] In its efficiency determination for this standard, DOE determined that this edition would result in significant savings relative to the 2018 IECC: 9.4 percent savings in annual site energy use intensity (EUI); 8.8 percent in annual source EUI; 8.7 percent in annual energy cost savings; and 8.7 percent reduction in carbon emissions.[84] The 2021 standard will yield a national weighted energy cost savings of 34.4 percent over the current USDA–HUD baseline 2009 standard.

In their qualitative assessment of the code, PNNL identified a total of 114 approved code changes or addenda in this edition of the code over the prior edition, of which 35 will have a direct impact on energy use in residential buildings. Of these, 29 are expected to reduce energy use, while six are expected to increase energy use.[85]

The following are the primary technical changes in the 2021 IECC over the previous edition:

• *Building Envelope.* Building envelope revisions include increased insulation requirements; more efficient U factors and Solar Heat Gain Coefficients (SHGCs) for windows and fenestration; maximum air leakage rate of 5 Air Changes per Hour (ACH) at 50 pascals for all compliance paths, with 3 ACH for Climate Zones 3–8 following the prescriptive path. Testing alternatives are provided for smaller homes and attached single family and multifamily buildings.[86]

[75] Sources: DOE, 2012: *https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22068.pdf;* 2015: *https://www.energycodes.gov/sites/default/files/2021-07/2015_IECC_FinalDeterminationAnalysis.pdf;* 2018: *https://www.energycodes.gov/sites/default/files/2021-07/EERE-2018-BT-DET-0014-0008.pdf,* 2021: *https://www.regulations.gov/document/EERE-2021-BT-DET-0010-0006.*

[76] U.S. Department of Energy, ''*Updating State Residential Building Energy Efficiency Codes: notice of Final Determination.*'' 77 FR 29322 (May 17, 2012). *http://www.gpo.gov/fdsys/pkg/FR-2012-05-17/pdf/2012-12000.pdf.*

[77] Pacific Northwest National Laboratory, *Cost-Effectiveness Analysis of the 2009 and 2012 IECC Residential Provisions—Technical Support Document,* U.S. Department of Energy, PNNL–22068, April 2013. *https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22068.pdf.*

[78] Pacific Northwest National Laboratory, *Guide to the Changes between the 2009 and 2012 International Energy Conservation Code,* U.S. Department of Energy, PNNL–21435, May 2012. *http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-21435.pdf.*

[79] Pacific Northwest National Laboratory, *Energy savings for a Typical New Residential Dwelling Unit Based on the 2009 and 2012 IECC as Compared to the 2006 IECC,* Letter Report, PNNL–88603, April 2013, Table 1.

[80] Pacific Northwest National Laboratory, *Cost-Effectiveness Analysis of the 2009 and 2012 IECC Residential Provisions—Technical Support Document,* U.S. Department of Energy, PNNL–22068, Tables 8.1 and 8.4, April 2013.

[81] U.S. Department of Energy, *Determination Regarding Energy Efficiency Improvements in the 2015 International Energy Conservation Code,* 80 FR 33250 (June 11, 2015), *https://www.federalregister.gov/documents/2015/06/11/2015-14297/determination-regarding-energy-efficiency-improvements-in-the-2015-international-energy-conservation.*

[82] DOE, ''*Final Determination Regarding energy efficiency Improvements in the 2018 International Energy Conservation Code,*'' 84 FR 67435 (Dec. 10, 2019), *https://www.federalregister.gov/documents/2019/12/10/2019-26550/final-determination-regarding-energy-efficiency-improvements-in-the-2018-international-energy;* also PNNL for DOE, *Energy Savings Analysis: 2018 IECC for Residential Buildings,* November 2019, *https://www.energycodes.gov/sites/default/files/2021-07/EERE-2018-BT-DET-0014-0008.pdf.*

[83] International Code Council, *2021 International Energy Conservation Code,* January 29, 2021. *https://codes.iccsafe.org/content/IECC2021P1.*

[84] 86 FR 40529 (July 28, 2021), *Analysis Regarding Energy Efficiency Improvements in the 2021 International Energy Conservation Code (IECC) https://www.federalregister.gov/documents/2021/07/28/2021-15969/analysis-regarding-energy-efficiency-improvements-in-the-2021-international-energy-conservation-code;* also PNNL, *Preliminary Energy Savings Analysis: 2021 IECC for Residential Buildings,* April 2021, *https://www.energycodes.gov/sites/default/files/2021-07/2021_IECC_PreliminaryDetermination_TSD.pdf.*

[85] 79 additional changes were determined to be administrative or impact non-energy portions of the code.

[86] AMCA International, *International Energy Conservation Code: 2021 Changes, Getting Involved in the 2024 Process,* May 5, 2021, *https://*

Continued

• *Heating, Ventilation and Air Condition (HVAC).* Mechanical ventilation in Climate Zones 7 and 8 provided by a Heat Recovery Ventilator (HRV) or Energy Recovery Ventilator (ERV) is required for the prescriptive compliance path.[87]

• *Additional Efficiency Options.* Additional efficiency options in the 2021 IECC include an enhanced envelope performance option—a 5 percent improvement in proposed home UA value (R408.2.1); a more efficient HVAC equipment option (highlighted above); a reduced energy use in service water heating option 0.82 EF for fossil fuel, 2.0 EF for electric fuels or 0.4 solar fraction water heater (R405.2.3); a more efficient duct thermal distribution system option—100 percent of ducts in conditioned space or ductless systems (R405.2.4); and an improved air sealing and efficient ventilation option—air leakage at 3.0 ACH50 with ERV or HRV with 75 percent Sensible Recovery Efficiency (SRE) (R405.2.5).

• *Lighting Changes.* The efficacy value of high-efficacy lamps increases to 70 lumens/watt (100 percent of lighting), a 10 percent increase over the 2018 standard.

• *Renewables.* The 2021 IECC revises the definition for ''on-site renewables'' for consistency with other national standards; adds a definition for biogas and biomass; and requires that Renewable Energy Certificates (RECS) be retired with the homeowner when using the ERI compliance approach.[88]

• *Zero Energy Appendix.* In addition to these technical changes, the 2021 IECC includes, for the first time, a Zero Energy Appendix that requires compliance with an ERI score without renewables and then achieving an ERI score of ''0'' with renewables. This provides jurisdictions with an opportunity to adopt a base or stretch code that achieves zero energy in homes and low-rise multifamily buildings.[89]

• *Building Electrification.* While the 2021 IECC did not include building electrification provisions in the final version of the code, provisions are available for adoption by states as amendments to the 2021 IECC: RE147–19, Electrification-Ready; RE126–19, Energy Efficient Water Heating; RE107–19, Eliminate Continuous Burning Pilot Light.

• *Compliance Pathways.* There are three compliance pathways in the 2021 IECC: Prescriptive, Performance, and Energy Rating Index or ERI, which reverted to IECC 2015 levels. The prescriptive paths can follow the R-value minimum table, the U-Factor equivalent table, or the UA equivalent alternative. All compliance pathways now have required Additional Efficiency Options (AEOs) to achieve five percent greater energy efficiency than base levels. The 2021 IECC lowers the performance path ERI scores compared to the 2018 IECC.

3. Current State Adoption of the 2021 IECC

There is typically a lag time between the publication of a new edition of the IECC and state adoption of the code: Table 11 and Figure 1 show that, as of December 2023, while all but eight states have adopted a version of the IECC, only five states (California, Washington, Vermont, New Jersey, and Connecticut) have adopted the 2021 IECC or its equivalent.[90]

Overall, 41 states plus the District of Columbia have adopted a version of the code that is equivalent to or higher than the current HUD and USDA standard of the 2009 IECC. Of these, only 18 states plus the District of Columbia have adopted a code above the 2009 IECC (the 2018 IECC, the 2015 IECC, or equivalent to the 2021 IECC),[91] while 23 states have set their codes at the 2009 IECC or its equivalent. The remaining 9 states have either adopted standards that pre-date the 2009 IECC (1 state) or have no state-wide codes (8 states).

Based on historical experience and the continued consideration or adoption of the 2021 IECC by states, it is anticipated that over time additional states are likely to adopt the 2021 IECC, either as published by the ICC or with amendments.

www.amca.org/assets/resources/public/assets/uploads/FINAL-_ICC_Webinar-_presentation_May_5__2021.pdf.

[87] Northeast Energy Efficiency Partnerships, *Key Changes in the 2021 IECC for the Northeast and Mid-Atlantic, https://neep.org/sites/default/files/media-files/2021_iecc_one-pager_.pdf.*

[88] New Buildings Institute, *2021 IECC National Model Energy Code (Base Codes). https://newbuildings.org/code_policy/2021-iecc-base-codes/.*

[89] Ibid.

[90] California's Title 24 2019 Building Energy Efficiency standard, Washington's 2018 State Energy Code, and Vermont's amendments to the 2018 IECC were determined to meet or exceed the 2021 IECC.

[91] PNNL, *State Level Residential Codes Energy Use Index, FY 2023Q2,* Excel File at *https://www.energycodes.gov/state-portal.*

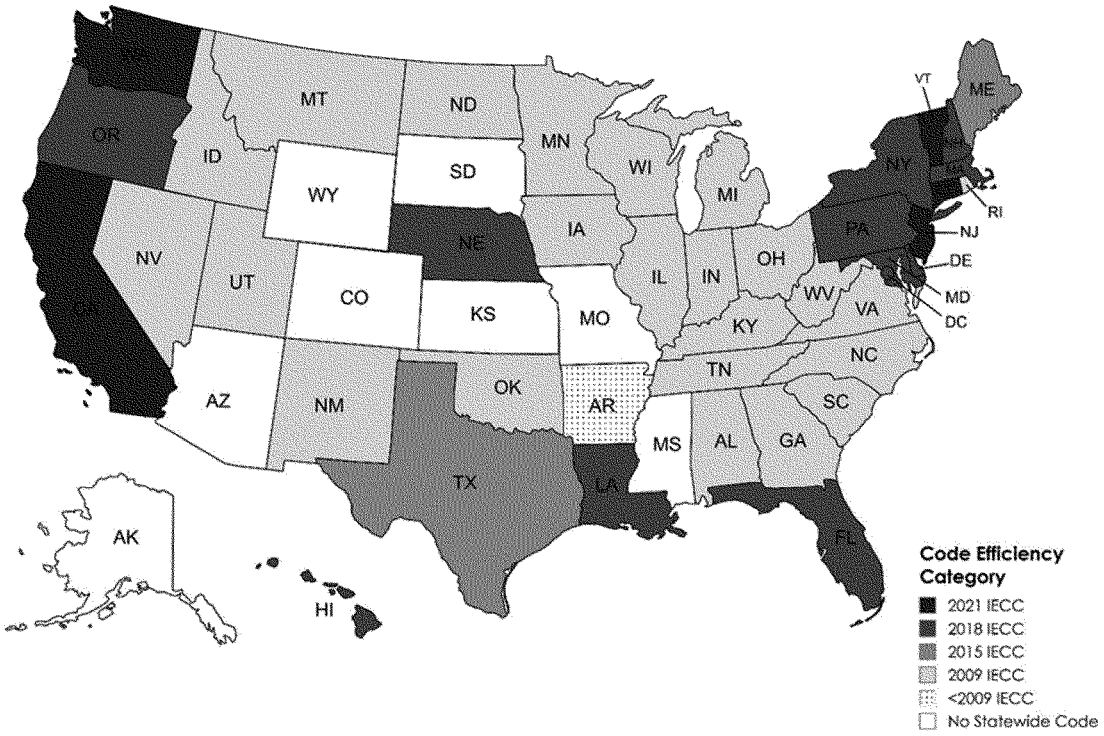
Table 11. Current State Adoption of the IECC (As of December 2023)

Above Current HUD and USDA Standard (18 states + DC)	
2021 IECC or Equivalent (5)	
California	Vermont
Connecticut	Washington
New Jersey	
2018 IECC or Equivalent (11 states + DC)	
Delaware	Massachusetts
District of Columbia	Nebraska
Florida	New Hampshire
Hawaii*	New York
Louisiana	Oregon
Maryland	Pennsylvania
2015 IECC or Equivalent (2)	
Maine	Texas
Current HUD and USDA Standard (23 States)	
2009 IECC or Equivalent	
Alabama	North Carolina
Georgia	North Dakota
Idaho	Ohio
Illinois	Oklahoma
Indiana	Rhode Island
Iowa	South Carolina
Kentucky	Tennessee
Michigan	Utah
Minnesota	Virginia
Montana	West Virginia
Nevada	Wisconsin
New Mexico	
Older than 2009 IECC Or No Statewide Codes (9 States)	
Equivalent to Less Than 2009 IECC (1)	
Arkansas	
Home Rule/No statewide code (8)	
Alaska	Mississippi
Arizona*	Missouri
Colorado	South Dakota
Kansas	Wyoming
U.S. Territories	
American Samoa – No Code	N. Mariana Islands (2003 IECC equivalent)
Guam – 2009 IECC	Puerto Rico (2011 PR Building Standard)
U.S. Virgin Islands – 2009 IECC	

*A review of the codes in place across the state indicates that 86 percent (Hawaii) and 82 percent (Arizona) of the population is covered by codes at this level.

This tabulation is drawn from DOE's tracking of state adoptions of the IECC, available at DOE's state portal at *https://www.energycodes.gov/state-portal.* For the purpose of this notice, HUD and USDA rely on the December 2023 update of the status map maintained by DOE at this site. Figure 1 displays the state IECC adoption status shown in Table 11.

Figure 1. IECC Adoption Map (Residential)
Status as of December 2023



Note that states often adopt amendments to the code as published by the ICC. In some cases, these amendments will sufficiently alter the IECC code as published, such that the energy performance of buildings meeting the amended code provisions may be equivalent to that of a prior code.

The DOE code adoption map and the adopted codes listed in Table 11 reflect DOE/PNNL's analysis of state adopted codes (including amendments) and associated assessment of their IECC code equivalent. Accordingly, 18 states have adopted the 2012, 2015, 2018, or 2021 IECC with amendments and were determined by PNNL to be equivalent to the 2009 IECC. These are therefore shown in Table 11 and Figure 1 as at the 2009 IECC level.[92] Additionally, DOE provides an analysis of the energy use index of each state-adopted code on their state portal.[93]

Ohio, for example, adopted the 2018 IECC with amendments to basement and crawl space wall R-values, air leakage rates and the allowance to utilize framing cavities as return ducts.[94] DOE/PNNL determined that the Ohio code as adopted with amendments is equivalent to the 2009 IECC.[95] New Mexico adopted the New Mexico Energy Conservation Code, based on the 2018 IECC, with state-specific amendments which were determined by DOE/PNNL to yield a performance standard equivalent to the 2009 IECC. On the other hand, if the new code is less than one percent more efficient than the prior code then DOE counts the newer code as equivalent to the previous code. California has adopted its own standard, Title 24, which DOE has determined meets or exceeds the 2021 IECC.

In certain cases, home rule cities or counties within a State may adopt a different code from the rest of the State. For example, Austin, Texas has adopted the 2021 IECC energy code, thereby exceeding the minimum Texas statewide code of the 2015 IECC.[96] In instances where a local entity has a more stringent standard, the affordability impacts within a State will differ.[97]

4. Estimated Impacts

Table 12 provides an estimate of the average number of units that may be impacted annually by adoption of the 2021 IECC. HUD and USDA used prior-year production for these programs in order to estimate future annual production for these programs.[98] Based on average annual production for the three year 2019–21 period, the agencies estimate that a total of approximately 161,700 units of HUD- and USDA-financed or insured housing may be impacted by the 2021 IECC, of which 150,227 are in the 45 states plus DC and U.S. territories that have not yet adopted this standard.

[92] The 23 states deemed equivalent to the 2009 IECC are: AL, GA, ID, IL, IN, IA, KY, MI, MN, MT, NV, NM, NC, ND, OH, OK, RI, SC, TN, UT, VA, WV, WI. See Table for a listing of these code equivalents at *https://www.energycodes.gov/state-portal* and ''Reidential State Level Results'' Excel file at ''Available Data'' for detailed DOE/PNNL analysis.

[93] DOE, *State Portal, https://www.energycodes.gov/state-portal.*

[94] ACEEE, State Scorecard Ranking, *https://database.aceee.org/state/ohio.*

[95] See ''Residential State Level Results'' at *https://www.energycodes.gov/state-portal.*

[96] City of Austin, Building Technical Codes. *https://www.austintexas.gov/department/building-technical-codes.*

[97] HUD and USDA do not maintain a list of local communities that may have adopted a different code than their state code. See ACEEE, State and Local Policy Database for codes adopted by individual cities. *https://database.aceee.org/city/energy-code-stringency.*

[98] Three-year averages were used (2019–21) for all programs, except for public housing which used four-year 2016–2020 averages since limited data were available for the three-year period. Prior-year production data provided by program offices using internal tracking or reporting systems.

Table 12. Estimated Number of Units Impacted Annually by 2021 IECC[99]

State or Territory	FHA Single Family	USDA Guaranteed Loan Program	USDA Direct Loan Program	FHA Single Family – Condos	Public Housing	HOME	Housing Trust Fund	RAD	Low-Rise Multi-family	Total
AK	42	27	19	3	0	35	19	25	0	170
AL	1,975	611	27	0	52	60	0	0	321	3,046
AR	1,024	453	52	0	0	145	12	16	164	1,866
AZ	4,595	391	90	54	0	97	0	38	432	5,697
CA (2021)	5,629	136	339	803	12	880	0	12	166	7,977
CO	2,701	151	42	65	13	199	1	10	682	3,864
CT (2021)	70	9	0	7	23	42	0	0	125	276
DC	17	0	0	8	12	0	0	0	137	174
DE	584	179	25	20	0	5	0	48	0	860.5
FL	19,178	1,119	189	24	146	366	87	21	1,477	22,607
GA	7,977	731	45	17	32	139	0	0	795	9,736
HI	77	61	39	40	3	33	0	0	0	253
IA	224	44	5	0	0	16	5	0	0	294
ID	812	134	13	0	0	56	29	73	11	1,128
IL	750	10	2	4	35	96	0	0	404	1,301
IN	1,890	205	137	1	0	121	0	0	49	2,403
KS	161	29	1	0	0	39	30	0	55	315
KY	798	277	66	13	0	71	0	2	188	1,415
LA	2,181	1,036	42	0	12	189	2	3	124	3,589
MA	174	7	7	11	0	20	0	35	491	745
MD	2,073	171	5	150	0	143	0	0	849	3,391
ME	116	48	16	0	0	40	30	24	15	288.5
MI	227	73	32	234	16	93	0	0	102	777
MN	542	99	16	1	3	120	0	5	607	1,393
MO	896	306	6	2	0	236	2	0	444	1,892
MS	1,048	304	43	2	1	0	0	0	0	1,398
MT	120	50	22	0	0	35	3	21	68	318.5
NC	4,977	1,211	165	2	7	724	25	0	1,321	8,432
ND	112	14	1	0	0	27	13	0	0	167
NE	177	9	1	0	0	17	0	0	297	501
NH	69	5	1	2	0	50	6	46	106	285
NJ (2021)	477	8	3	43	42	151	0	0	50	774
NM	751	21	26	0	0	11	15	12	115	950.5
NV	1,642	52	6	101	4	408	3	1	92	2,309

State or Territory	FHA Single Family	USDA Guaranteed Loan Program	USDA Direct Loan Program	FHA Single Family – Condos	Public Housing	HOME	Housing Trust Fund	RAD	Low-Rise Multi-family	Total
NY	233	5	6	3	15	262	0	27	1,445	1,996
OH	1,339	51	17	25	10	229	0	0	105	1,776
OK	1,464	288	41	0	0	34	13	10	81	1,931
OR	703	127	31	22	0	142	12	30	38	1,105
PA	697	78	13	4	43	90	0	0	85	1,010
RI	64	0	3	1	0	3	23	2	35	130.5
SC	4,169	992	87	3	0	44	0	0	236	5,531
SD	148	49	16	1	0	124	75	37	12	461.5
TN	3,355	644	55	9	2	39	30	103	751	4,988
TX	32,070	1,670	98	325	83	243	57	0	6,684	41,230
UT	1,679	417	127	103	0	7	0	17	476	2,826
VA	2,119	416	71	178	12	85	45	0	924	3,850
VT (2021)	10	4	2	0	0	59	24	0	9	108
WA (2021)	1,529	128	81	45	15	107	6	31	413	2,355
WI	168	24	7	0	5	85	0	0	173	462
WV	298	221	3	0	0	12	10	5	71	620
WY	55	32	3	0	0	16	1	0	18	125
Territories										
Guam			8			18				26
Mariana Isl.			9			3				12
Puerto Rico	186	284	53		53	5				581
Total	**114,372**	**13,411**	**2,214**	**2,326**	**651**	**6,271**	**578**	**645**	**21,243**	**161,711**
45 states	106,657	13,126	1,789	1,478	559	5,032	548	611	20,480	150,227

Table 12 includes both single family and low-rise multifamily housing. Of the total, in the 45 states and the U.S. territories that have not yet adopted the 2021 IECC, approximately 106,650 units are estimated to be FHA-insured new single family homes; approximately 13,100 units are USDA Section 502 direct loans, and 1,800 units are Section 502 guaranteed loans. The remaining single family units are financed through the HOME program (5,000 units), HUD's Public and Indian Housing (PIH) programs (approximately 600 units through the Choice Neighborhoods and Capital Fund Financing Programs), and 500 units through the Housing Trust Fund program. Also included in Table 12 are some 20,200 FHA-insured multifamily housing units financed with FHA multifamily insurance that are estimated to be low-rise multifamily and therefore covered under the 2021 IECC.[100] When adjusted to exclude units in states that have already adopted codes equivalent to the 2021 IECC (California, Connecticut, New Jersey, Vermont, Washington), the total potential number of estimated units potentially impacted decreases to around 150,000 units.

Note that the volume of estimated production is not evenly distributed across the states but reflects historic demand for FHA and USDA financing for one or more of the agencies' programs: two states, Texas (24 percent) and Florida (14 percent), account for almost 40 percent of potentially impacted units based on prior-year production. As noted above, Austin, Texas, has already adopted the 2021 IECC, as have 86 other Texas home-rule jurisdictions albeit often with amendments. Given Texas and Florida have passed more current iterations of the IECC since 2009, and one or more areas of Texas is IECC 2021 compliant, it is possible builders will be more adaptable to constructing in accordance with the 2021 IECC. Along with Georgia (6 percent), North Carolina (6 percent) and California (5 percent), five states account for more than half of all potentially impacted units (56 percent). Note that historical production is used as a guide to future production; actual state by state unit counts in the future may vary from these estimates, based on actual supply and demand.

[99] Estimated count of impacted units does not include the Project-Based Voucher program. There is insufficient data on the annual use of this program for new construction. Additionally, it is likely that, in most cases, Project-Based Vouchers are used for new construction projects that also rely on one or more of the other programs included in this table.

[100] In order to derive the number of low-rise multifamily units, the following assumptions were made: for FHA units, 50 percent of all multifamily units are assumed to be low-rise; for public housing units, all units coded as ''multifamily/walkup apartments'' are assumed to be low-rise; and for HOME units, all units in multifamily developments with less than 100 units are assumed to be low-rise, as well as 50 percent of all units in developments with more than 100 units.

B. 2021 IECC Affordability Analysis

In this notice, HUD and USDA address two aspects of housing affordability in assessing the impact that the revised code will have on housing affordability. As described further below, the primary affordability test is a life-cycle cost savings (LCC) test, *i.e.,* the extent to which the additional, or incremental, investments required to comply with the revised code are cost effective inasmuch as the additional measures pay for themselves with energy cost savings over a typical 30-year mortgage period. A second test is whether the incremental cost of complying with the code as a share of total construction costs—regardless of the energy savings associated with the investment—is affordable to the borrower or renter of the home.

Note that there may be other benefits associated with energy efficient building codes in addition to energy cost savings. These include increased resilience against extreme temperature events, the potential for lowering mortgage defaults, and lowering the disproportionate energy burden for low-moderate income households. In addition, studies show that added energy efficiency may also yield improved health outcomes.[101]

A 2023 study from PNNL found that energy efficiency measures improve the habitability of single family buildings during extreme cold and extreme heat events by up to 120 percent and 140 percent, respectively.[102] With the frequency and intensity of extreme weather events, particularly heatwaves, expected to increase, the improved resilience of energy efficient buildings will save lives. In 2020, 34 million U.S. households, or 27 percent of all households, reported difficulty paying their energy bills or kept their homes at an unsafe temperature because of energy cost concerns, according to the Energy Information Administration.[103] In some cases, homes perform so poorly that the energy bills impact spending choices about allocating financial resources for other necessities, like food, clothing, transportation, and medical care.[104] Excessive energy bills can create a snowball effect, leading to mortgage defaults, missed opportunities to participate in job training and educational opportunities, and family separations, ultimately increasing wealth inequality. Poor-performing homes can even cause physical harm and death in extreme heat and cold events during power outages.[105]

Another benefit may be the potential for lower mortgage defaults associated with improved energy efficiency. A study by the University of North Carolina (UNC) Center for Community Capital and the Institute for Market Transformation (IMT) shows a correlation between greater energy efficiency and lower mortgage default risk for new homes. The UNC study surveyed 71,000 Energy Star-rated homes and found that mortgage default risks are 32 percent lower for these more energy efficient homes than homes without Energy Star ratings.[106]

1. Cost Benefit Analysis and Results

The baseline analysis used for this Determination is the PNNL study prepared for DOE, *National Cost Effectiveness of the Residential Provisions of the 2021 IECC,* published in June 2021. This analysis estimates annual energy and cost savings as well as life-cycle cost (LCC) savings that assume initial costs are mortgaged over 30 years.[107] The study provides an assessment of both the initial costs as well as the long-term estimated savings and cost-benefits associated with complying with the 2021 IECC.

HUD and USDA have adopted a modified version of the DOE methodology. These modifications include adding a supply chain cost increase factor and energy price increase factor to adjusted for inflation from 2020 to 2023 as well as cost and savings adjustment factors that reflect the smaller FHA home relative to the prototypes used in the PNNL model. Additionally, one difference in this approach is that it does not take into account replacement costs or residual value, which are factored in for the PNNL model. The RIA explains the reasoning for this difference on page 25. The modifications to the DOE methodology have been included to respond to public comments that the HUD-USDA analysis take into account current market and economic conditions as well as the specific features of HUD-USDA financing and characteristics of the FHA-USDA borrower.

The LCC method used by DOE And adapted by HUD and USDA for this final determination is a ''robust cost-benefit metric that sums the costs and benefits of a code change over a specified time frame. LCC is a well-known approach to assessing cost-effectiveness'' [108] and reflects extensive prior public comment and input. In September 2011, DOE solicited input on their proposed cost-benefit methodology [109] and this input was incorporated into the final methodology posted on DOE's website in April 2012 and further updated in August 2015.[110] [111]

For this analysis, DOE calculates energy use for new homes using EnergyPlusT energy modeling software, Version 9.4.[112] Two buildings are simulated: (1) a two-story single family home, with 2,376 square feet of conditioned floor area, excluding the conditioned basement (if any), and a window area equal to 15 percent of the conditioned floor area; and (2) a low-rise apartment building (a three-story multifamily prototype with six 1,200 square-foot dwelling units per floor) with a window area of approximately 23 percent of the exterior wall area. DOE combines the results into a composite average dwelling unit based on Census building permit data for each state and for eight Climate Zones. Single family home construction is more common than low-rise multifamily construction;

[101] See, for example, DOE, Jonathan Wilson et al, Home Rx: *The Health Benefits of Home Performance,* December 2016; HUD, *BRIGHT Study Finds Improved Health at Boston Housing Authority's Old Colony Homes, https://www.huduser.gov/portal/casestudies/study-05042017.html.*

[102] Franconi, E, E Hotchkiss, T Hong, M Reiner et al. 2023. *Enhancing Resilience in Buildings through Energy Efficiency.* Richland, WA: Pacific Northwest National Laboratory. PNNL–32737, Rev 1.

[103] Energy Information Administration, *https://www.eia.gov/todayinenergy/detail.php?id=51979.*

[104] *https://fahe.org/wp-content/uploads/Summary-of-Issues-Facing-Rural-Housing-V1.2.pdf.*

[105] National Institutes of Health, *https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10249403/.*

[106] UNC Center for Community Capital, Institute for Market Transformation, ''Home Energy Efficiency and Mortgage Risks,'' March 2013, Available at: *http://www.imt.org/uploads/resources/files/IMT_UNC_HomeEEMortgageRisksfinal.pdf.*

[107] PNNL, Salcido et al, *National Cost Effectiveness of the Residential Provisions of the 2021 IECC,* June 2021. *https://www.energycodes.gov/sites/default/files/2021-07/2021IECC_CostEffectiveness_Final_Residential.pdf.*

[108] Department of Energy, *National Energy and Cost Savings for new Single- and Multifamily Homes: A Comparison of the 2006, 2009 and 2012 Editions of the IECC.* April 2012, p. A–1, *https://www.energycodes.gov/sites/default/files/2020-06/NationalResidentialCostEffectiveness_2009_2012.pdf.*

[109] 76 FR 56413 (Sep. 13, 2011).

[110] Pacific Northwest National Laboratory for the Department of Energy (Z. Taylor, R. Lucas, N. Fernandez) *Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes.* April 2012. Available at: *http://www.energy.sc.gov/files/view/Taylor%202012.pdf.*

[111] Pacific Northwest National Laboratory for the Department of Energy (V. Mendon, R. Lucas, S. Goel), *Cost-Effectiveness Analysis of the 2009 and 2012 IECC Residential Provisions—Technical Support Document. April 2013,* Available at *https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22068.pdf.*

[112] Pacific Northwest National Laboratory for the Department of Energy (Z. Taylor, V. Mendon, N. Fernandez), *Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes,* August 2015, *https://www.energycodes.gov/sites/default/files/2021-07/residential_methodology_2015.pdf.*

the results are weighted accordingly to reflect this for each Climate Zone as well as each state.

Four heating systems are considered for modeling the energy savings in these building prototypes: natural gas furnaces, oil furnaces, electric heat pumps, and electric resistance furnaces. The market share of heating system types is obtained from the U.S. Department of Energy Residential Energy Consumption Survey (2015). Domestic water heating systems are assumed to use the same fuel as the space heating system.

2. Limitations of Cost Savings Models

HUD and USDA are aware of studies that discuss limitations associated with cost-savings models such as those developed by PNNL for DOE. For example, Allcott and Greenstone suggest that ''it is difficult to take at face value the quantitative conclusions of the engineering analyses'' associated with these models, as they suffer from several empirical problems. The authors cite two problems in particular. First, engineering costs typically incorporate upfront capital costs only and omit opportunity costs or other unobserved factors. For example, one study found that nearly half of the investments that engineering assessments showed in energy audits for medium-size businesses that would have short payback periods were not adopted due to unaccounted physical costs, risks, or opportunity costs. Second, engineering estimates of energy savings can overstate true field returns, sometimes by a large amount, and some engineering simulation models have still not been fully calibrated to approximate actual returns.[113] HUD and USDA nevertheless believe that the PNNL-DOE model used to estimate the savings shown in this notice represents the current state-of-the art for such modeling, is the product of significant public comment and input, is now the standard for all of DOE's energy code simulations and models, and presents a reliable and validated methodology for estimating energy code costs and benefits.

3. Estimated Costs and Savings

For all 50 states and the District of Columbia, DOE estimates that for a weighted average of both single family and low-rise multifamily housing, the 2021 IECC saves 9.38 percent of energy costs for heating, cooling, water heating, and lighting over the 2018 IECC.[114] For the purposes of this notice, DOE provided HUD and USDA with a special tabulation that disaggregates this analysis into each building type (single family and low-rise multifamily). The disaggregated data are shown in Tables 13 (single family) and 14 (low-rise multifamily) for the following data points: LCC savings, incremental cost, annual mortgage increase, down-payment and other up-front costs, net first year annual cash flow, years to positive cash flow, and simple payback for the 2021 IECC in relation to the current HUD and USDA baseline of the 2009 IECC. Tables 13 and 14 provide both national average costs and benefits, as well as for each climate zone.

The United States has eight Climate Zones, further subdivided to represent moist, dry, or marine climates, that are listed here: 1A Very hot humid; 2A Hot Humid; 2B Hot Dry; 3A Warm Humid; 3B Warm Dry; 3C Warm Marine; 4A Mixed Humid; 4B Mixed Dry; 4C Mixed Marine; 5A Cool Humid; 5B Cool Dry; 6A Cold Humid; 6B Cold Dry; 7 Very Cold; and 8 Subarctic/Arctic. Zone 1 includes Hawaii, Guam, Puerto Rico, and the Virgin Islands. Almost all of Alaska is in Zone 7.[115]

Tables 13 and 14 show the economics of adopting the 2021 IECC nationally and in each Climate Zone, relative to the 2009 IECC baseline. Table 15 shows costs and savings against the 2018 IECC baseline. Data points provided include, incremental or first costs, annual energy savings, increased debt service on a thirty-year mortgage, estimated down payment and closing costs, net annual cash flow in the first year, and simple payback on the initial investment.[116]

4. Analysis of Adopted State Energy Codes for Residential Buildings

The Department of Energy assesses the energy code adopted by each state, considering the impact of any included amendments to the original IECC code. This analysis can be found in the ''residential state-level results'' available for download at *https://www.energycodes.gov/state-portal.* The analysis shows the energy index, which is the modeled energy use based on the adopted energy code, for the adopted code of each state as well as multiple versions of the IECC. A comparison of the energy index for the IECC code and any state-adopted version with amendments demonstrates the impact of amendments to the code on energy efficiency.

5. Incremental or Added Costs

Tables 13 shows the average per-unit incremental cost of adopting the 2021 IECC over the current HUD and USDA 2009 IECC baseline for single family homes, both nationally and for each Climate Zone: a national average of an estimated $7,229 per unit for single family housing,[117] ranging from a low of $3,662 in Climate Zone 1, to a high of $8,845 in Climate Zone 8. Cost data sources used to derive these costs include: Building Component Cost Community (BC3) data repository; construction cost data collected by Faithful+Gould under contract with PNNL; RS Means Residential Cost Data; National Residential Efficiency Measures Database; and price data from nationally recognized home supply stores.[118]

[113] Hunt Allcott and Michael Greenstone, ''Is there an energy efficiency gap?'' Journal of Economic Perspectives, Volume 26, Number 1,Winter 2012, pp. 3–28.

[114] PNNL, Salcido et al., 2021.

[115] DOE, *IECC climate zone map, https://basc.pnnl.gov/images/iecc-climate-zone-map.*

[116] The 2009 standard is used as the primary baseline for this analysis since, as shown in Table 11, 23 states still require a standard equivalent to the 2009 baseline, which is also the most recent baseline established by HUD and USDA, while eleven states and the District of Columbia have adopted the 2018 standard. However, Tables 19 and 20 below shows baseline data for individual states per data provided by DOE/PNNL based on the state adoption status in 2021, which has seven states and the District of Columbia at the 2018 IECC.

[117] Source: Data provided by DOE to HUD and USDA showing disaggregated LCC Savings, Incremental Cost, and Annual Energy Savings for single family and low-rise multifamily homes.

[118] See for example, PNNL, *Alaska Cost Effectiveness Analysis, https://www.energycodes.gov/sites/default/files/2021-06/AlaskaResidentialCostEffectiveness_2018.pdf.*

Table 13. National Costs and Benefits – 2021 IECC vs. 2009 IECC (Single Family) (2023 dollars)

Climate Zone	LCC Savings ($)	30 Year PV Benefits ($)	Incremental cost ($)	Annual energy savings ($)	Annual Mortgage Increase ($)	Down payment and other up-front costs ($)	Net annual cashflow for year one ($)	Years to positive cashflow	Simple Payback (Yrs)
National Average	15,071	25,124	7,229	963	439	550	377	1.5	7.7
CZ 1	10,774	15,866	3,662	608	222	279	311	0.9	6.2
CZ 2	8,313	15,871	5,436	608	330	414	168	2.5	9.2
CZ 3	13,917	25,093	8,037	961	488	612	311	2.0	8.6
CZ 4	19,989	31,965	8,613	1,225	523	656	527	1.2	7.2
CZ 5	17,691	28,467	7,750	1,091	471	590	463	1.3	7.3
CZ 6	29,834	39,409	6,886	1,510	418	524	952	0.6	4.7
CZ 7	39,308	51,604	8,843	1,977	537	673	1,261	0.5	4.6
CZ 8	52,078	64,377	8,845	2,467	537	673	1,750	0.4	3.7

6. Annual Cost Savings

Table 13 summarizes the first-year annual energy cost savings per single family dwelling unit for the 2021 IECC compared to the 2009 IECC, aggregated over 16 single family residential prototype buildings modeled by DOE/PNNL.[119] Modeled energy savings are converted to cost savings using the most recent residential fuel prices from DOE's Energy Information Administration (EIA).[120] Cost savings stated are time zero dollars not adjusted for inflation or fuel price escalation. The per-unit annual energy cost savings for single family homes is estimated to be $963 per unit, ranging from $608/unit in Climate Zones 1 and 2, to a high of $2,467 in Climate Zone 8.

7. Simple Payback

Simple payback is a commonly used measure of cost effectiveness, defined as the number of years required for the sum of the annual returns on an investment to equal the original investment. The simple payback for adoption of the 2021 IECC code is an estimated 7.7 years for single family homes, ranging from 3.7 years in Climate Zone 8 to 9.2 years in Climate Zone 2.

8. Total Life Cycle Cost Savings

LCC analysis computes overall cost savings per dwelling unit resulting from implementing efficiency improvements. LCC savings are based on the net change in overall cash flows (energy savings minus additional costs) resulting from implementing the new code. LCC savings are a sum over an analysis period of 30 years: future cash flows vary from year to year and are discounted to present values using a discount rate that accounts for the changing value of money over time. LCC is the primary metric used by DOE to determine the cost effectiveness of the code or specific code changes. The economic analysis assumes that initial costs are mortgaged, and that homeowners do not take advantage of the mortgage interest deduction since most FHA/USDA borrowers are likely to take the standard, non-itemized tax deduction.[121]

Net life cycle cost savings shown in Table 13 average $15,071 per housing unit for adoption of the latest 2021 IECC. LCC savings vary considerably by Climate Zone, from as low as $8,313 in Climate Zone 2 to a high of $52,078 in Climate Zone 8.

9. Consumer Cash Flows

Converting first costs and annual savings to Consumer Cash Flows is an important component of the affordability analysis. Consumer Cash Flow results are derived from the year-by-year calculations that underlie LCC savings and provide an assessment of how annual cost outlays are compensated by annual energy savings and the time required for cumulative energy savings to exceed cumulative costs, including both increased mortgage payments and down payment and other up-front costs.

The financial and economic parameters used by HUD in calculating LCC savings and annual cash flow are based on DOE's cost-effectiveness methodology. Based on public comments, HUD has revised the original DOE analysis to incorporate new economic parameters that better reflect current market and economic conditions. Figure 2 shows the original and revised parameters. These revised parameters account for significant changes in construction, labor, and energy costs as well as several adjustments to financing terms to better reflect HUD and USDA borrowers.

[119] For residential buildings, PNNL uses two base prototypes to simulate (1) a single family detached house and (2) a multifamily low-rise apartment building. These prototypes are modified to accommodate four different heating system types and four foundation types typically found in residential new construction. The result is an expended set of 32 models (16 for each building type) which is then simulated across 18 climate locations for each edition of the IECC. This results in a set of 3,552 energy models in EnergyPlus Version 9.5).

[120] U.S. Energy Information Administration, Washington, D.C. Natural Gas Prices, *https://www.eia.gov/dnav/ng/ng_pri_sum_a_EPG0_PRS_DMcf_m.htm*. Electric Power Monthly, *https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_06_b*. Petroleum and Other Liquids. *https://www.eia.gov/dnav/pet/PET_PRI_WFR_A_EPD2F_PRS_DPGAL_W.htm*..

[121] PNNL, Salcido et al., 2021.

Figure 2. Economic Parameters for Consumer Cash Flows

Parameter	Preliminary Determination[122]	Final Determination
Mortgage interest rate	3.0%	Real: 3.0% Nominal: 5.3%
Loan fees	1% of mortgage amount	1% of mortgage amount
Loan term	30 years	30 years
Down payment	12.0%	5.0%
Discount rate (equal to mortgage rate)	3.0%	Real: 3.0% Nominal: 5.3%
Inflation rate	1.4%	2.24%
Marginal Federal income tax	12%	-
Marginal State income tax	% Varies by State	-
Property tax	1.24%	1.5%
Supply Chain Cost Increase Factor	-	37.0%
Energy Price Increase Factor	-	32.0%
Fuel Price Escalator (Nominal)	-	1.9%
FHA Savings Reduction Factor	-	3.0%
FHA Cost Reduction Factor	-	5.0%

Annual cash flow is defined as the net difference between annual energy savings and annual cash outlays (mortgage payments, etc.), including all tax effects but excluding up-front costs (mortgage down payment, loan fees, etc.). Only first year net cash flow is reported: subsequent years' cash flow will differ due to the effects of inflation and fuel price escalation, changing income tax effects as the mortgage interest payments decline, etc. Assuming a 5 percent, 30-year fixed mortgage, and a 5 percent down payment, increased annual debt service is shown in Table 13 to be an average of $439/unit, or $36.58/month, with annual energy savings more than twice that amount: $963, or $80.25/month. This translates into a net annual positive cash flow in Year One of $377 or $31.42/month. Years to Positive Cash Flow, *i.e.,* the number of years needed to recoup the cost of the initial down payment and first-year debt service with annual savings, is just eighteen months on average.

10. Low-Rise Multifamily Buildings

Table 14 shows costs and savings for low-rise multifamily housing similar to those shown in Table 13 for single family homes. The costs and savings shown are aggregated over 16 low-rise multifamily residential prototype buildings modeled by DOE/PNNL.[123] The incremental costs for this housing type, as well as associated savings, are generally lower than for single family homes, as a result of both differences in unit size and building type. Incremental costs average $3,002/unit nationally, more than half of the $7,229 per unit cost for single family housing only. Net LCC savings of $6,345 for low-rise multifamily housing are also projected to be lower than for single family housing only ($15,071/unit).

First year increased debt service for low-rise multifamily housing is estimated to be $182/unit, while savings are nearly three times that amount: $403/year, for a net annual cash flow of $160/year. While costs and savings differ, Years to Positive Cash Flow are similar to that of single family homes (1.4 years), and the national Simple Payback average of 7.6 years is also comparable. Simple paybacks range from a low of 5.1 years in Climate Zone 8 to a high of 8.2 years in Climate Zones 2 and 3. Net LCC savings vary considerably from $5,218 in Climate Zone 2 to a high of $18,185 in Climate Zone 8. Higher incremental or added costs typically translate into higher annual savings, with net annual positive cash flows for year one ranging from $123 to $565.

[122] PNNL, Salcido et al., 2021.

[123] See Footnote 47 for methodology for prototype buildings.

Table 14. National Costs and Benefits – 2021 vs. 2009 IECC (Low-Rise Multifamily) (2023 dollars)

Climate Zone	LCC Savings ($)	30 Year PV Benefits ($)	Incremental cost ($)	Annual energy savings ($)	Annual Mortgage Increase ($)	Down payment and other up-front costs ($)	Net annual cashflow for year one ($)	Years to positive cashflow	Simple payback (years)
National Average	6,345	10,519	3,002	403	182	229	160	1.4	7.6
CZ 1	6,308	9,359	2,194	359	133	167	181	0.9	6.3
CZ 2	5,218	9,089	2,784	348	169	212	123	1.7	8.2
CZ 3	5,978	10,453	3,218	401	196	245	140	1.8	8.2
CZ 4	7,047	11,340	3,088	434	188	235	184	1.3	7.3
CZ 5	6,087	10,267	3,006	393	183	229	150	1.5	7.8
CZ 6	9,735	13,621	2,795	522	170	213	296	0.7	5.5
CZ 7	13,188	19,788	4,747	758	288	361	374	1.0	6.4
CZ 8	18,185	24,784	4,746	950	288	361	565	0.6	5.1

Table 15 shows the energy savings and incremental costs of construction for the average housing unit (average of single family and multifamily). First costs average $2,620 per unit, well below the average first cost of $7,229 against the 2009 baseline. As would be expected, annual savings are similarly lower, and the resulting national average payback is higher than the 2009 IECC—at 10.7 years vs. 7.7 years against the 2009 IECC. Simple paybacks vary considerably across Climate Zones, from 4.8 years in Climate Zone 1 to 16.8 years in Climate Zone 5.

Table 15. National Costs and Benefits – 2021 vs. 2018 IECC[124] (2023 dollars)

Area	Upfront Cost for Single Family ($)	Upfront Cost for Condo ($)	Upfront Cost for Average Unit ($)	First Year Energy Savings for Average Unit ($)	Simple Payback for Average Unit (years)
National Average	3,087	1,713	2,620	245	10.7
Climate Zone 1: Very Hot	1,218	1,214	1,217	256	4.8
Climate Zone 2: Hot	1,991	1,492	1,822	246	7.4
Climate Zone 3: Warm	2,419	1,551	2,124	256	8.3
Climate Zone 4: Mixed	4,799	1,995	3,847	262	14.7
Climate Zone 5: Cool	4,645	1,935	3,725	222	16.8
Climate Zone 6: Cold	1,922	1,434	1,757	157	11.2
Climate Zone 7: Very Cold	3,878	3,388	3,712	392	9.5
Climate Zone 8: Subarctic/Arctic	3,881	3,388	3,713	526	7.1

Notes: Single family cost and condo cost and average energy savings from PNNL. Upfront cost derived by HUD and simple payback calculated by HUD. HUD does not have disaggregated estimates for single family and multifamily units for the update from 2018, only the average across single family and low-rise multifamily

11. Additional analysis—6 Percent Mortgage Interest Rate and 3.5 Percent Down Payment

Table 16 provides cash flow analysis for single family housing using a 3.5 percent downpayment consistent with minimum FHA requirements, and a 6.5 percent nominal mortgage interest rate predicted to be in place at the end of 2024 (compared to 5% average downpayment and 5.3 percent mortgage interest rates used in Tables 13–15, above). The cash flows are similar to the prior analysis, with positive cash flows ranging from less than a year to 2.8 years and simple paybacks below 10 years.

[124] HUD does not have PNNL estimates of energy savings disaggregated by single family and multifamily for the 2021 IECC relative to the 2018 standard. HUD computed a weighted average of the incremental cost of construction. The weights used by PNNL in their analysis are 66 percent for single family units and 34 percent for low-rise multifamily units.

Table 16. National Costs and Benefits – 2021 IECC vs. 2009 IECC (Single Family) 6.5% mortgage rate; 3.5% down payment. (2023 dollars)

Climate Zone	LCC Savings ($)	30 Year PV Benefits ($)	Incremental cost ($)	Annual energy savings ($)	Annual Mortgage Increase ($)	Down payment and other up-front costs ($)	Net annual cashflow for year one ($)	Years to positive cashflow	Simple Payback (Yrs)
National Average	14,182	25,124	7,229	963	502	445	314	1.4	7.7
CZ 1	10,323	15,866	3,662	608	254	225	279	0.8	6.2
CZ 2	7,644	15,871	5,436	608	377	335	121	2.8	9.2
CZ 3	12,928	25,093	8,037	961	558	495	241	2.1	8.6
CZ 4	18,929	31,965	8,613	1,225	598	530	452	1.2	7.2
CZ 5	16,737	28,467	7,750	1,091	538	477	396	1.2	7.3
CZ 6	28,986	39,409	6,886	1,510	478	424	892	0.5	4.7
CZ 7	38,219	51,604	8,843	1,977	614	544	1,184	0.5	4.6
CZ 8	50,989	64,377	8,845	2,467	614	544	1,673	0.3	3.7

12. Cash Flows for Single Family and Low-Rise Multifamily

HUD and USDA rely on a 30-year term for the loan based on guidance from DOE. Tables 13 and 14 show net life-cycle costs of $15,071 (single family) and $6,345 (low-rise multifamily) for the 2021 IECC over the 2009 IECC. In both cases, positive cashflows occur by the end of the second year. Table 17 and 18 present the cumulative, present value cash flow for each building type at the one-, two-, five-, 10-, 20-, and 30-year marks as well as with no loan. The tables show cash flows for the national average as well as each climate zone.

LCC savings for periods of less than 30 years also show positive cash flows. At the 10-year mark, the national savings are estimated to be $2,515 over the 2009 IECC and $1,076 over the 2018 IECC.

Table 17. Cash Flow for Single Family –2021 IECC vs. 2009 IECC (2023 dollars)

Period	National	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8
First Year (incl. upfront cost)	(173)	33	(246)	(301)	(128)	(127)	428	588	1,077
First Year (excl. upfront cost)	377	311	168	311	527	463	952	1,261	1,750
Second Year	407	329	188	342	565	497	993	1,314	1,813
5 Year	1,506	1,353	565	1,141	2,176	1,903	4,342	5,763	8,161
10 Year	**3,908**	**3,131**	**1,831**	**3,304**	**5,401**	**4,752**	**9,397**	**12,433**	**17,115**
20 Year	9,321	6,916	4,898	8,378	12,525	11,064	19,696	25,989	34,914
30 Year	15,071	10,774	8,313	13,917	19,989	17,691	29,834	39,308	52,078
PV No loan	17,380	11,943	10,048	16,483	22,739	20,166	32,033	42,131	54,902

Table 18. Cash Flow for Low-Rise Multifamily –2021 IECC vs. 2009 IECC (2023 dollars)

Period	National	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8
First Year (incl. upfront cost)	(69)	14	(89)	(105)	(51)	(79)	83	12	204
First Year (excl. upfront cost)	160	181	123	140	184	150	296	374	565
Second Year	173	191	134	153	198	162	310	396	591
5 Year	642	783	470	533	758	592	1,316	1,607	2,546
10 Year	**1,654**	**1,822**	**1,290**	**1,471**	**1,893**	**1,559**	**2,944**	**3,773**	**5,605**
20 Year	3,931	4,041	3,180	3,638	4,407	3,750	6,335	8,421	11,914
30 Year	6,345	6,308	5,218	5,978	7,047	6,087	9,735	13,188	18,185
PV No loan	7,304	7,009	6,107	7,006	8,033	7,047	10,627	14,703	19,701

12. Appraisals of Energy Efficiency Improvements

In this section of the determination, we address the question of home appraisals, and the extent to which they fully value energy efficiency improvements. As noted in the response to public comments received on this topic, the residential appraisal system in the U.S. is not generally set up to fully assign a contributory value to increased energy efficiency of a home, particularly in the absence of sales comparisons, in part because of imperfect information—the level of energy efficiency is not typically disclosed at the time of home purchase, unless the home has a HERS rating, or it has an energy efficient certification such as Energy Star or Zero Energy Ready Homes. In addition to information availability necessary to identify and develop the contributory value of energy efficient measures in a residential appraisal, the valuation requires a market recognizable response, appraiser technical expertise and training, and underwriter recognition of the approaches, methods and techniques applied in support of the conclusions.

As discussed in the comments section of this notice, however, there are several mitigating factors, as well as emerging trends that indicate that tools are available to the appraiser that when properly applied allow for adjustments to as-is valuations. In addition, studies of sales prices in Washington, DC and other markets show that energy efficient homes command higher sales prices.[125] A review of sales prices of FHA homes for the past four years relative to appraised values show that a significant share—32 percent—are valued at more than $5,000 or more above the sales price, thereby allowing a significant margin for borrowers to accommodate the estimated increase in value associated with the 2021 IECC. There is also increasing use of the MLS that have ''green'' fields including energy certifications, HERS ratings, and in some cases utility costs associated with a home (existing homes), which provide both lenders and appraisers with the necessary information needed to incorporate in the home valuation. In addition, while still underutilized, tools such as the Green Addendum that is available to appraisers and can be filled out by HERS raters (or even the homeowner) are available to identify the energy features of a home. See Section A.5 in the Comments section of this notice for a discussion of these issues. HUD and USDA plan to implement a robust training and technical assistance program for both appraisers and lenders to maximize the use of accurate and reliable valuation methods and will work with the rosters of FHA- and USDA-approved appraisers to provide such training.

14. State-Level Results [126] [127]

Table 19 provides a state-by-state breakout of estimated costs and savings, for single family homes only. This table provides a more granular breakout of estimated costs and savings than the national and Climate Zone averages shown in Table 13 above, using the HUD and USDA 2009 IECC baseline for those states that have not yet adopted this standard or its equivalent as well as a 2018 IECC baseline for the 7 states plus the District of Columbia that have adopted the 2018 IECC or its equivalent.[128] [129] All states have positive LCC savings and meet the necessary affordability requirements.

DOE did not provide HUD and USDA with a cost effectiveness analysis for the U.S. territories—American Samoa, Guam, North Mariana Islands, Puerto Rico, and U.S. Virgin Islands. In situations without a state-or territory-specific cost effectiveness analysis, the cost effectiveness analysis for the climate zone is used to determine affordability. As shown in Table 13, climate zone 1, the climate zone for each of the U.S. territories, has LCC savings of $10,774, which meets the affordability requirements. The climate zone also has an incremental cost of $3,662, annual energy savings of $608, and a simple payback period of 6.2 years.

[125] Adomatis, Sandra, ''What is Green Worth? Unveiling High Performance Home Premiums in Washington DC,'' September 2015, *https://doee.dc.gov/sites/default/files/dc/sites/ddoe/service_content/attachments/2015_High Performance%20Home%20Valuation%20Report_FINAL.pdf.*

[126] State-level results are based on PNNL analyses on the cost-effectiveness of the 2021 IECC for residential buildings in each state. As such, Tables 19 and 20 present the cost-effectiveness of the 2021 IECC for each state based on their adopted energy code in July 2021. States that have revised their energy code requirements since July 2021 should look to other states in the same climate zone with the same energy code requirements for estimated costs and savings.

[127] State results use state-specific property tax rates provided in the PNNL analyses on the cost-effectiveness of the 2021 IECC for residential buildings in each state instead of the national property tax rate of 1.5 percent.

[128] Cost benefit data are not available for three states (California, Washington, and Oregon). According to DOE, these codes ≥deviate significantly from the model codes≥ and as a result DOE has historically not analyzed those states.

[129] The 2018 data shown in Tables 19 and 20 are aggregated single family and low-rise multifamily data adjusted for the weighted averages used by PNNL for the 2009 IECC.

Table 19. State by State Costs and Benefits – 2021 IECC vs. 2009 or 2018 IECC (Single Family)[130] (2023 dollars)

State	Current Code	Incremental Cost ($)	Increase Downpayment ($)	Annual Mortgage ($)	Annual Energy Savings ($)	LCC Savings ($)	30 Year PV Benefits ($)	Simple Payback (Years)
AK	2009	11,523	576	700	2,849	59,402	74,355	4.2
AL	2009	6,332	317	385	931	17,001	24,310	7.0
AR	2009	6,974	349	424	993	17,597	25,914	7.2
AZ	2009	5,418	271	329	639	10,003	16,683	8.7
CA	2021	-	-	-	-	-	-	-
CO	2009	7,534	377	458	704	9,257	18,363	11.0
CT	2021	-	-	-	-	-	-	-
DC	2018	3,231	162	196	508	9,453	13,268	6.5
DE	2018	4,409	220	268	381	4,766	9,944	11.9
FL	2009	4,385	219	266	564	9,092	14,720	8.0
GA	2009	6,804	340	413	969	16,740	25,281	7.2
HI	2009	3,046	152	185	1,354	31,865	35,338	2.3
IA	2009	7,410	371	450	1,278	23,370	33,359	6.0
ID	2009	6,887	344	418	631	8,013	16,463	11.2
IL	2009	8,443	422	513	870	10,570	22,702	10.0
IN	2009	8,079	404	491	891	13,083	23,256	9.3
KS	2009	7,604	380	462	1,184	20,656	30,906	6.6
KY	2009	8,295	415	504	1,227	21,808	32,036	7.0
LA	2009	5,147	257	313	574	9,202	14,987	9.2
MA	2018	1,274	64	77	145	2,132	3,786	9.0
MD	2018	3,232	162	196	414	6,730	10,813	8.0
ME	2009	6,420	321	390	1,478	30,190	38,586	4.5

MI	2009	7,558	378	459	1,198	20,576	31,269	6.5
MN	2009	7,583	379	461	1,461	28,277	38,132	5.3
MO	2009	8,721	436	530	1,058	16,538	27,626	8.5
MS	2009	6,332	317	385	856	14,790	22,342	7.6
MT	2009	6,423	321	390	720	10,729	18,791	9.2
NC	2009	6,753	338	410	959	16,630	25,038	7.2
ND	2009	6,667	333	405	1,249	23,449	32,611	5.5
NE	2018	4,376	219	266	270	732	7,046	16.7
NH	2009	7,213	380	425	1,274	22,686	33,239	5.8
NJ	2021	-	-	-	-	-	-	-
NM	2009	7,663	383	466	703	9,157	18,343	11.2
NV	2009	8,700	435	529	778	9,368	20,306	11.5
NY	2018	3,837	192	233	495	7,782	12,907	8.0
OH	2009	7,774	389	472	895	12,760	23,350	8.9
OK	2009	6,987	349	424	1,058	18,960	27,603	6.8
OR	2018	-	-	-	-	-	-	-
PA	2009	8,445	422	513	1,101	17,249	28,736	7.9
PR	2011 PR Building Code	-	-	-	-	-	-	-
RI	2009	8,293	415	504	1,396	25,160	36,440	6.1
SC	2009	6,357	318	386	937	16,911	24,467	7.0
SD	2009	5,847	292	355	1,244	24,587	32,457	4.8
TN	2009	7,238	362	440	957	16,120	24,986	7.8
TX	2018	2,016	101	122	276	4,286	7,215	7.5
UT	2009	6,817	341	414	664	9,092	17,332	10.6
VA	2009	7,675	384	466	1,158	20,726	30,220	6.8
VT	2021	-	-	-	-	-	-	-
WA	2021	-	-	-	-	-	-	-
WI	2009	7,578	379	460	1,104	17,875	28,810	7.1
WV	2009	8,360	418	508	1,208	21,597	31,517	7.1
WY	2009	6,394	320	388	912	16,095	23,798	7.2

Incremental costs for adoption of the 2021 IECC in those states currently at the 2009 IECC or its equivalent range from a low of $3,046 (Hawaii) to a high of $11,523 (Alaska), with most states typically in the $6,000 range. Annual energy savings exceed added debt service in all states with energy savings ranging from a low of $564 (Florida) to a high of $2,849 (Alaska).

Both incremental costs and savings for the 2021 IECC in the 11 states plus the District of Columbia that have adopted the 2018 IECC are typically lower than for those at the 2009 IECC baseline. New York, for example, shows an added cost of $3,837/unit for adoption of the 2021 IECC relative to its current 2018 baseline, $495 in annual estimated savings, yielding LCC savings of $7,782.

15. Total Costs and Benefits

Table 20 provide estimated up-front costs, annual energy cost savings, and life cycle cost savings for the 2021 IECC for all 50 states and the District of Columbia, weighted by the estimated share of single family and low-rise multifamily units potentially impacted by the adoption of the 2021 IECC. As previously shown in Table 12, an estimated 140,000 single family and low-rise multifamily units would be impacted annually by this code if adopted today. By multiplying the incremental cost/unit per state by the number of units estimated likely to be impacted, the total cost of implementing the 2021 IECC is estimated at $605.4 million, total savings are estimated at $2.1 billion, and net life-cycle cost savings of $1.3 billion.[131]

[130] Current code is set at the 2009 IECC, the current HUD requirement, for states at or below the 2009 IECC based on the standard adopted by each state as of July 2021, which was when PNNL conducted their state analysis for the 2021 IECC. States that have since adopted the 2021 IECC show no impact as they current require the proposed standard. As shown in Table 11, some states have adopted a state code that is below the current HUD/USDA standard (2009 IECC) or have not yet adopted any state code.

[131] Net LCC savings of $1.3 billion are based on life-cycle costs of $770 million and life-cycle savings of $2.1 billion over the 30-year period.

Table 20. Aggregate Estimated Costs and Savings for 2021 IECC (Single Family and Low-Rise Multifamily) (2023 dollars)

State	Current Code	Total Incremental Cost Per State ($)	Total Annual Energy Cost Savings Per State ($)	Life-Cycle Cost (LCC) Savings ($)	Simple Payback (Years)
AK	2009	1,467,302	362,749	7,563,877	4.0
AL	2009	15,751,159	2,322,686	42,441,810	6.8
AR	2009	10,787,851	1,539,224	27,308,371	7.0
AZ	2009	25,877,923	3,055,881	47,851,967	8.5
CA	2021	-	-	-	-
CO	2009	22,048,256	2,059,004	27,089,312	10.7
CT	2021	-	-	-	-
DC	2018	789,874	123,257	2,284,586	6.4
DE	2018	7,557,323	652,990	8,167,536	11.6
FL	2009	78,027,936	10,085,227	163,080,925	7.7
GA	2009	54,200,100	7,732,423	133,786,239	7.0
HI	2009	641,349	278,936	6,549,083	2.3
IA	2009	2,865,479	491,595	8,967,910	5.8
ID	2009	6,458,270	591,494	7,514,250	10.9
IL	2009	10,184,197	1,049,049	12,746,796	9.7
IN	2009	15,080,067	1,663,982	24,440,942	9.1
KS	2009	3,917,376	610,412	10,651,023	6.4
KY	2009	14,501,366	2,149,551	38,223,760	6.7
LA	2009	12,046,255	1,350,091	21,698,030	8.9
MA	2018	359,843	113,426	2,493,512	3.2
MD	2018	8,987,272	1,137,731	18,341,653	7.9
ME	2009	1,380,494	316,587	6,457,741	4.4
MI	2009	5,157,941	809,020	13,818,750	6.4
MN	2009	7,105,575	1,304,653	24,817,262	5.4
MO	2009	11,327,527	1,381,200	21,648,400	8.2
MS	2009	8,145,813	1,101,578	19,036,644	7.4
MT	2009	1,556,448	174,178	2,592,446	8.9
NC	2009	40,733,576	5,819,749	101,179,307	7.0
ND	2009	1,369,480	256,657	4,816,719	5.3

State	Current Code	Total Incremental Cost Per State ($)	Total Annual Energy Cost Savings Per State ($)	Life-Cycle Cost (LCC) Savings ($)	Simple Payback (Years)
NE	2018	1,330,406	79,978	167,721	16.6
NH	2009	1,347,422	234,827	4,157,578	5.7
NJ	2021	-	-	-	-
NM	2009	7,489,828	689,004	9,005,317	10.9
NV	2009	18,406,827	1,646,889	19,842,774	11.2
NY	2018	1,764,960	207,634	3,061,397	8.5
OH	2009	11,549,503	1,328,498	18,941,414	8.7
OK	2009	11,554,693	1,747,839	31,325,528	6.6
OR	2018	-	-	-	-
PA	2009	8,043,921	1,049,813	16,459,200	7.7
PR	2011 PR Building Code	-	-	-	-
RI	2009	674,452	112,658	2,023,038	6.0
SC	2009	30,174,298	4,459,928	80,540,750	6.8
SD	2009	1,571,406	331,691	6,542,036	4.7
TN	2009	29,623,159	3,934,188	66,397,370	7.5
TX	2018	66,546,268	8,937,478	136,575,571	7.4
UT	2009	16,672,620	1,627,949	22,336,566	10.2
VA	2009	23,199,372	3,534,206	63,545,340	6.6
VT	2021	-	-	-	-
WA	2021	-	-	-	-
WI	2006	1,807,146	261,252	4,211,113	6.9
WV	2009	4,583,037	661,985	11,839,942	6.9
WY	2009	730,032	103,282	1,816,195	7.1

This LCC figure covers a single year's cohort of HUD and USDA financed housing. Annual effects will increase as more cohorts are added to the stock of new HUD- and USDA-assisted, insured, or guaranteed energy-efficient housing. In the second year, with two cohorts in place, there could be a stream of almost $150 million (future value) of energy savings. The number of units affected every year will decline as states update their standards to the 2021 IECC, or industry adopts the prescribed above-code standards. Thus, we expect the aggregate annual incremental effects to taper off. The maximum annual effect of all cohorts is not likely to exceed somewhere between three or four times the annual effect of a single-year cohort. While a new code edition is typically published every three years, since HUD and USDA must consider the affordability and availability impacts of each edition when it is published, in this notice, LCC savings cover one year's cohort. See ''Aggregate Incremental Impacts of IECC Update'' in the Regulatory Impact Analysis (p.44) for further discussion.

The Regulatory Impact Analysis at *www.regulations.gov* provides an estimated first cost of $553 million, annual energy savings of $73 million, and net LCC savings that range from $972 million (7 percent real discount factor) to $1.48 billion (3 percent real discount factor). (See RIA Figures 20 and 21).

C. Final Affordability Determination—2021 IECC

Based on the analysis provided above, HUD and USDA have determined that adoption of the 2021 IECC will not negatively impact the affordability of homes covered by the statute. This conclusion recognizes the profile of FHA borrowers, who according to FHA's 2021 Annual Report are typically first-time home buyers (84 percent) who are more likely than repeat buyers to be especially price sensitive.

While the national average incremental cost shown in Table 13 of adopting this standard is $7,229, this represents a modest 2.2 percent increase in the median cost of $330,000 for a new FHA-insured home in 2023. In all cases this translates into an increase in the downpayment and other first costs, on average, of $445, which represents approximately 0.13 percent of the median FHA-insured new energy efficient home mortgage.[132]

Unlike other added costs associated with the home purchase transaction, these incremental costs yield significant cost savings to the borrower. As shown in Tables 13–15, cash flows are extremely favorable for all types of housing covered by the IECC (single family and low-rise multifamily), for the 2021 IECC against both the 2009 IECC and the 2018 IECC baselines, in all Climate Zones, and for both life cycle cost savings as well as first year savings to the consumer. In all cases, annual energy savings in Year One exceed increases in debt service. Using the national average for the 2021 IECC over the 2009 IECC as a base case, as shown in Table 13, debt service increases average just $36/month ($439/year) for net positive cash flows of $31/month ($377/year) after debt service. Consumers are expected to see energy savings of $963 annually, and a net positive cash flow of $377 in the first year. On a life cycle basis, consumers are projected to save $25,100 in energy bills over the life of a typical 30-year mortgage, and a net life cycle savings (after costs) of $15,071. Years to positive

[132] Average USDA Section 502 Direct Loan 2018–20 of $191,100, and of Section 502 Guaranteed Loan of $210,700. Incremental cost of $7,229 equals 3.0 percent and 2.8 percent respectively of these loans; down payment and other upfront costs are 0.28 percent and 0.26 percent. For average FHA new home mortgage of $363,000 (2023), added first cost equals 2.0 percent, average down payment and other upfront costs equals 0.15 percent.

cash flow range average 1.5 years and range from less than six months to 2.5 years depending on Climate Zone. The simple payback—the years required to recoup the full cost of the code update—averages 7.7 years and is less than 10 years in all Climate Zones, ranging from a low of 3.7 years to a high of 9.2 years.

While there is likely to be variability in actual cash flows depending on energy use associated with family size and behavior, the data shows that on average the adoption of these measures are likely to improve overall affordability in light of these positive cash flows.

While the cash flows and lifetime cost savings are positive, an additional affordability consideration is whether increased down payment costs due to the added or incremental cost will negatively impact home buyers with regard to qualifying for a mortgage, or to meet mortgage down payment requirements. This is especially important for first-time home buyers who typically have lower cash availability for down payments. As shown in Table 13, HUD estimates increased average down payment and other up-front costs of $550, ranging from $279 to $673 for FHA-insured mortgages (varying by Climate Zone).[133] This is based on an assumed average 5 percent down payment.

HUD and USDA do not view these additional downpayment requirements as a barrier to qualifying for financing: a borrower purchasing a median FHA new energy code-compliant home of $337,200 will need an additional downpayment of $360 (5 percent down) plus an additional $190 for variable closing costs, including $126 (1.75 percent) for the Upfront Mortgage Insurance Premium (MIP) for a total of $550. A cash-constrained borrower may be able to finance the Upfront MIP in the mortgage and in doing so would still be well above the minimum FHA down payment requirement of 3.5 percent. Amortizing this amount will add a nominal additional monthly mortgage payment, yet result in an average of $80 per month or $963 a year in energy savings from this investment. The borrower who is already contributing the minimum 3.5 percent downpayment required by FHA will need an average of an additional $252 down payment (3.5 percent of $7,229 added average cost) over the $11,550 downpayment required for a non-energy code compliant home. In the event that the borrower is not able to contribute this additional cash above the minimum 3.5 percent downpayment, we note the large number of down payment assistance programs that may be available to borrowers to close this gap.[134] For one program, the USDA Section 502 Direct Loan Program which serves low-income borrowers with 50–80 percent incomes, there is a zero down payment requirement; for these borrowers the incremental down payment will by default present no affordability challenges. Longer amortization schedules (up to 38 years for up to 60 percent AMI borrowers) can also be used to lower monthly payments for Direct Loan borrowers if needed.

Note that energy costs and savings are generally not factored into current underwriting practices for single family mortgages, *i.e.,* while positive cash flows related to improved energy efficiency will be realized, they are not specifically included in the Principal Interest, Taxes, and Insurance (PITI) debt-to-income ratios typically used by lenders to qualify borrowers. Multifamily underwriting, on the other hand, does take into account energy savings: FHA offers the Green Mortgage Insurance Premium to multifamily borrowers who build to a green building standard, which may include the most recent energy code as a mandatory element, or may offer additional points if the building meets or exceeds the latest IECC or ASHRAE 90.1 standard.

Equity Impacts

The Regulatory Impact Analysis (RIA) that accompanies this notice includes an extensive equity analysis, which discusses the disproportionate energy burden experience by low-income borrowers—and conversely the increased benefits likely to be realized by low-income borrowers from increased efficiency. See the Equity Impacts section of the RIA (p.98) at *www.regulations.gov.*

Lower-income households face disproportionately higher energy burdens; they spend a higher share of their gross household income on energy costs.[135] Two-thirds of low-income households earning up to 200 percent of the federal poverty level face high energy burdens, spending more than 6 percent of their income on energy bills. Black, Hispanic, Native American, and older adult households, as well as families residing in manufactured housing and low-income households with a person with a disability, experience disproportionately high energy burdens.[136]

Since increasing energy efficient codes will lower the energy burden for buyers of energy efficient homes, more efficient codes will at the same time be most beneficial to lower-income households. These codes typically require added first costs, but HUD and USDA single family insured or guaranteed programs include mitigating factors which may make this investment more affordable to eligible borrowers, *e.g.,* lower down payment requirements (3.5 percent for FHA-backed mortgages compared to 20 percent required for conventional financing without mortgage insurance), as well as more flexible underwriting requirements such as lower allowable credit scores. USDA's Direct Loan program serves an underserved market, very low or extremely low-income borrowers in rural areas, through no-or low-down payment requirements, as well as significant interest rate subsidies. FHA's low-rise multifamily housing serves a renter population that is not directly responsible for any additional first costs.

The overall conclusion provided in the RIA concerning the equity impacts of a minimum energy standard is that lower-income households will benefit more from the existence of energy-efficient housing but may be challenged in their ability to address first costs. Empirical work has shown that residential energy is a necessary good, but that reducing its cost through energy efficiency requires an additional investment that lower-income households may not have the disposable income to accommodate. If, however, the notice encourages the supply of energy efficiency in the affordable housing stock, then low-income households will gain. Precise impacts are likely to vary by housing market and climate zone.

[133] Average price in 2023 for all FHA-insured purchases, including existing homes, was $363,000.

[134] See, for example, *https://nwhomepartners.org/get-ready-help-for-homebuyers/down-payment-help/,* or *https://www.energy.gov/scep/slsc/low-income-community-energy-solutions.*

[135] *https://www.energy.gov/scep/slsc/low-income-community-energy-solutions.*

[136] Drehobl, A.L. Ross, and R. Ayala. 2020. How High Are Household Energy Burdens? Washington, DC: American Council for an Energy-Efficient Economy.

IV. Final Determination—ASHRAE 90.1–2019

Overview

EISA requires HUD to consider the adoption of revisions to ASHRAE 90.1 for HUD-assisted multifamily programs.[137] Published and revised every three years in coordination with the publication schedule of the IECC, the standard provides minimum requirements for the energy-efficient design of commercial buildings, including residential buildings with more than three stories.[138]

ASHRAE 90.1 includes several compliance pathways. The first is the prescriptive path, which establishes energy-related criteria for individual building components, including minimum insulation levels, maximum lighting power, and controls for lighting and heating, ventilation, air conditioning, and refrigeration systems. Some requirements are considered mandatory, even when one of the optional paths is utilized. ASHRAE 90.1 also includes two optional whole-building performance paths. The first is the Energy Cost Budget method, which allows the designer to trade off compliance among various code requirements, using established energy modeling protocols. A building is deemed in compliance when the annual energy cost of the proposed design is no greater than the annual energy cost of the reference building design (baseline). ASHRAE 90.1 also includes a second performance approach, the Performance Rating Method in Appendix G. Appendix G has been used to rate the performance of buildings that exceed the requirements of Standard 90.1 for above-code programs, such as LEED, Green Globes, ASHRAE Standard 189.1, the International Green Construction Code, the National Green Building Standard, and other above-code programs.

1. Current HUD and USDA Standard and Subsequent Revisions

In their May 2015 Final Determination, HUD and USDA established the 2007 edition of ASHRAE 90.1 (ASHRAE 90.1–2007) as the minimum standard for HUD-assisted multifamily properties. ASHRAE has revised the code four times since the publication of the 2007 edition. ASHRAE 90.1–2010 was published in October 2010. There were 56 changes to the 2007 edition code with a positive impact on energy efficiency, including revised requirements for the building envelope, HVAC systems, commissioning, lighting, and power.[139] DOE determined that the ASHRAE 90.1–2010 code would yield national energy cost savings of 7.72 percent in mid-rise apartment buildings and 6.99 percent in high-rise apartment buildings over the previous 2007 code.[140]

The next edition, ASHRAE 90.1–2013, published in October 2013, included 52 changes over the 2010 edition, most of which were determined by DOE to be relatively minor. Only six were applicable to residential buildings, including improved lighting controls and decreased lighting power densities, increased building envelope requirements for ''opaque assemblies and fenestration,'' and increased efficiency requirements for smaller air conditioners and heat pumps.[141] These amendments resulted in an average energy savings of 5.4 percent in mid-rise apartment buildings and 6.9 percent in high-rise multifamily buildings (site energy) over ASHRAE 90.1–2010.[142] Cost savings were estimated by DOE to be 5.0 percent for mid-rise apartments and 8.7 percent for high-rise apartments.

The following edition, ASHRAE 90.1–2016, yielded an additional 3.6 percent site energy savings for mid-rise apartment buildings, and 4.0 percent for high-rise apartment buildings.[143] Energy cost savings were estimated by DOE to be 3.9 percent and 5.1 percent respectively over the 2013 edition for these two building types.

DOE's quantitative analysis concluded that ASHRAE 90.1–2019 for mid-rise and high-rise multifamily buildings (representing 11.65 percent of all commercial buildings) would yield an additional site energy savings of 2.65 percent over the 2016 edition, and energy cost savings (Energy Cost Index (ECI)) of 2.5 percent.[144] [145] [146]

Tables 21 and 22 show the changes in incremental costs for each code cycle since the 2007 edition. Table 21 shows that per square foot costs increased for the first two cycles (2010 and 2013) in a prototype mid-rise apartment building modeled by PNNL in five representative climate zones. In 2013, for example, the incremental cost of complying with ASHRAE 90.1–2019 ranged from just $0.17/sf to $0.69/sf, or 0.14 to 0.59 percent of total building costs. In contrast, the last two code cycles (both 2016 and 2019) have seen incremental cost savings rather than cost increases as a result of complying with these codes. In all cases, the incremental cost, whether a cost increase or a cost savings, is a small fraction of the total per building first cost ($111/sf in 2010 to $218/sf in 2019).

[137] USDA multifamily programs are not covered by the Act.

[138] Standard 90.1 is published in October of the year two years before the year listed for the IECC, to allow the latest version of standard 90.1 to be submitted to the IECC for inclusion in the commercial chapter of the IECC.

[139] A ''positive change'' is defined as a change to the code that results in increased energy efficiency. Other changes might include items that are either savings-neutral, or, in rare cases, may lower energy efficiency.

[140] Pacific Northwest National Laboratory for the Department of Energy, *Cost-effectiveness of ASHRAE Standard 90.1–2010 Compared to ASHRAE Standard 90.1–2007*, May 2013, Tables C.2, *http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22043.pdf.*

[141] PNNL, National Cost-effectiveness of ANSI/ASHRAE/IES Standard 90.1-2013, January 2015, *https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-23824.pdf.*

[142] U.S. Department of Energy, *Determination Regarding Energy Efficiency Improvements in ANSI/ASHRAE/IES Standard 90.1–2013: Energy Standard for Buildings, Except Low-Rise Residential Building,* Table IV.5, 79 FR 57900 (Sep. 26, 2014), *https://www.federalregister.gov/documents/2014/09/26/2014-22882/determination-regarding-energy-efficiency-improvements-in-ansiashraeies-standard-901-2013-energy.* For more detailed analysis, see PNNL, ANSI/ASHRAE/IES Standard 90.1–2013 Determination of Energy Savings: Quantitative Analysis, August 2014. Available at *https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-23479.pdf.*

[143] PNNL/DOE *Preliminary Energy Savings Analysis, ANSI/ASHRAE/IES Standard 90.1–2016*, June 2017, *https://www.energy.gov/sites/default/files/2017/07/f35/Preliminary_90.1-2016_Energy_Savings_Analysis.pdf.*

[144] Op cit., PNNL, *Energy Savings Analysis*, July 2021.

[145] PNNL, Impacts of Model Building Energy Codes—Interim Update, July 21, 2021, *https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-31437.pdf.* For all commercial buildings, DOE estimates national site energy savings of 4.7 percent and energy cost savings of approximately 4.3 percent.

[146] 86 FR 40543 (July 28, 2021), *Final Determination Regarding Energy Efficiency Improvements in ANSI/ASHRAE/IES Standard 90.1-2019, https://www.federalregister.gov/documents/2021/07/28/2021-15971/final-determination-regarding-energy-efficiency-improvements-in-ansiashraeies-standard-901-2019.*

Table 21. Incremental ASHRAE 90.1.-2019 Construction Costs ($/sf and %/sf)

Year	Building	2A	3A	3B	4A	5A
	First Cost	Tampa	Atlanta	El Paso	New York	Buffalo
	($/ft^2)	$/ft^2)	($/ft^2)	($/ft^2)	($/ft^2)	($/ft^2)
2019	$218	($0.36)	($0.37)	($0.40)	($0.30)	($0.29)
		-0.16%	-0.17%	-0.19%	-0.14%	-0.13%
2016	$194	($0.54)	($0.51)	($0.53)	($0.37)	($0.73)
		-0.28%	-0.27%	-0.27%	-0.19%	-0.38%
2013	$117	$0.17	$0.69	$0.69	$0.38	$0.58
		0.14%	0.59%	0.59%	0.33%	0.50%
2010	$111	$0.62	$0.62	$0.62	$0.62	$0.62
		0.56%	0.56%	0.56%	0.56%	0.56%

Table 22 shows building-level incremental cost or cost savings for each code cycle since 2007. In Climate Zone 2A (Tampa) for example, the incremental cost for the prototype mid-rise building was estimated to be $20,858 and $5,711 for the 2010 and 2013 editions respectively, followed by a combined savings of $30,167 in the following 2016 and 2019 codes.

Table 22. Incremental ASHRAE 90.1 Construction Costs ($/Prototype 32-Unit Building)

Code	Prototype Bldg First Cost	2A	3A	3B	4A	5A
		Tampa	Atlanta	El Paso	New York	Buffalo
	$/bldg	$/Bldg	$/Bldg	$/Bldg	$/Bldg	$/Bldg
2019	$7.36 million	($11,992)	($12,389)	($13,661)	($9,966)	($9,674)
2016	$6.55 million	($18,175)	($17,353)	($17,944)	($12,430)	($24,614)
2013	$3.95 million	$5,711	$23,214	$23,358	$12,891	$19,577
2010	$3.75 million	$20,858	$20,858	$20,858	$20,858	$20,858

2. ASHRAE 90.1–2019 Overview

This notice addresses ASHRAE 90.1–2019, which was the most recently published edition of ASHRAE 90.1 at the time of drafting the preliminary determination. In its qualitative analysis of the code, DOE identified a total of 88 changes, or addenda, to ASHRAE 90.1–2016.[147] [148] Twenty-nine changes were determined to have a positive impact on energy efficiency (*i.e.,* yield energy savings). These include: increased requirement for building vestibules, removal of data processing centers from exceptions to HVAC requirements, removal of hotel room exceptions to HVAC requirements, modification of demand-controlled ventilation requirements, modification of fan power limitations, modification of retail lighting requirements, modification of cooling tower testing requirements, modification of commercial boiler requirements, modification of part load fan requirements, modification of opaque envelope requirements, and modification of fenestration envelope requirements.

[147] Pacific Northwest National Laboratory for the U.S. Department of Energy, Energy Savings Analysis: *ANSI/ASHRAE/IES Standard 90.1–2019, July 21, 2021, https://www.energycodes.gov/sites/default/files/2021-07/Standard_90.1-2019_Final_Determination_TSD.pdf.*

[148] 148DOE determined that 59 of the 88 addenda will have a neutral impact on overall building efficiency; these included editorial changes, changes to reference standards, changes to alternative compliance paths, and other changes to the text of the standard that may improve the usability of the standard, but do not generally improve or degrade the energy efficiency of the building. Changes with impacts which do not become effective within three years from the publication of Standard 90.1–2019 (*i.e.,* until a cutoff date of December 31, 2022), are also considered as having no impact within the context of this analysis.

On March 6, 2024, DOE published an affirmative efficiency determination for ASHRAE 90.1–2022, which has additional energy savings.[149] The 2022 edition includes 89 addenda in total, of which 39 are expected to decrease energy use. With the publication of DOE's affirmative efficiency determination as required under the Energy Conservation and Policy Act, each state is now required to review the provisions of their commercial building code regarding energy efficiency, and, as necessary, update their codes to meet or exceed Standard 90.1–2022. This determination considered only ASHRAE 90.1–2019 because that was the most recent determination available to HUD and USDA at the time of developing the preliminary determination.[150]

3. Current State Adoption of ASHRAE 90.1–2019

Table 23 shows the current adoption status of ASHRAE 90.1 for mid-rise or high-rise multifamily buildings. As of December 2023, ten states and the District of Columbia have adopted ASHRAE 90.1–2019. A total of 33 states and the District of Columbia have adopted an ASHRAE 90.1 standard that is above the current HUD and USDA standard (one of the 2010, 2013, 2016, or 2019 editions), while 17 states have adopted codes that are currently equivalent to or below the current HUD and USDA standard or have no statewide codes.[151] Additionally, DOE provides an analysis of the energy use index of each state-adopted code on their state portal.[152]

[149] Energy Efficiency and Renewable Energy Office, *2024–03–06 Determination Regarding Energy Efficiency Improvements in ANSI/ASHRAE/IES Standard 90.1–2022; Notification of determination. https://www.regulations.gov/document/EERE-2023-BT-DET-0017-0001.*

[150] See ANSI/ASHRAE/IES Standard 90.1–2022 Changes for list of amendments. *www.ashrae.org/technical-resources/bookstore/ansi-ashrae-ies-standard-90-1-2022-changes.*

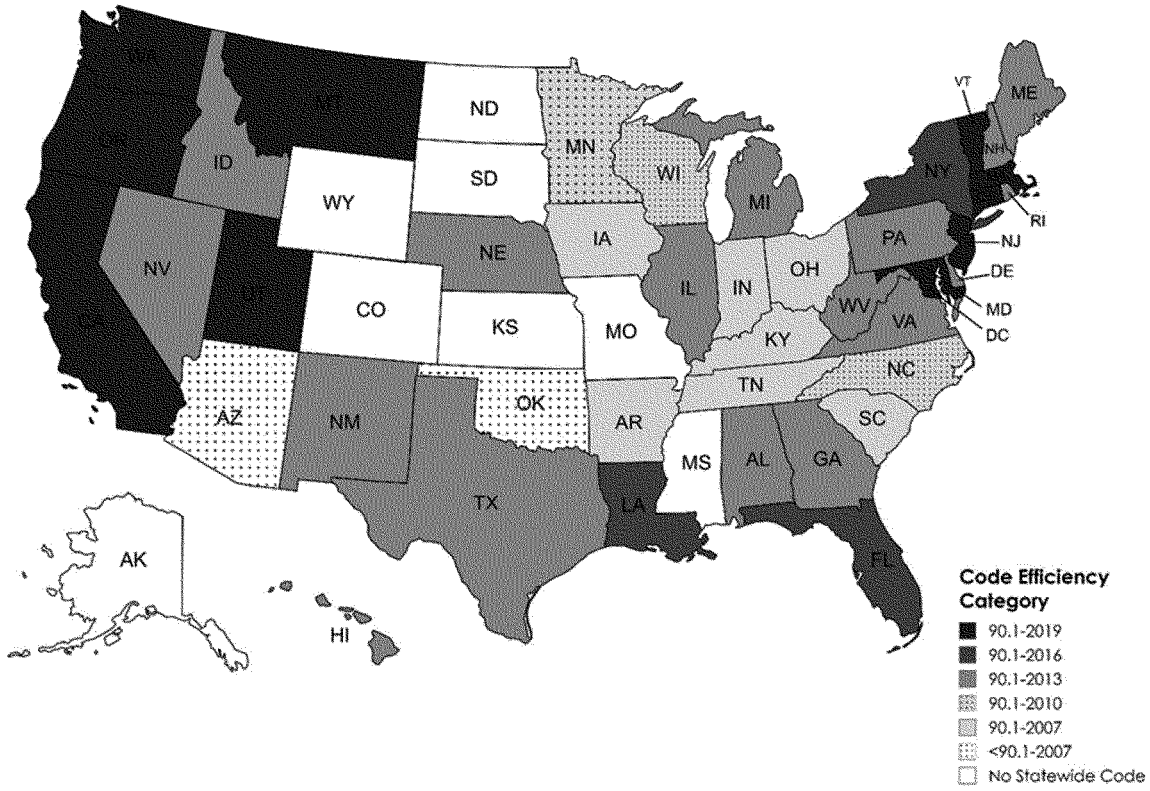
[151] DOE, *Status of State Energy Code Adoption—Commercial, https://www.energycodes.gov/status/commercial.* Note that the codes shown in Table 23 and Figure 3 represent DOE/PNNL's Determination of the standard that the state-adopted code is equivalent to, reflecting amendments that may have been adopted by each state.

[152] DOE, *State Portal, https://www.energycodes.gov/state-portal.*

Table 23. Current Adoption of ASHRAE 90.1 Multifamily Mid- and High-Rise Buildings (December 2023)

Above Current HUD and USDA Standard (33 states + DC)	
ASHRAE 90.1-2019 or Equivalent (10 states + DC)	
California	New Jersey
Connecticut	Oregon
District of Columbia	Utah
Maryland	Vermont
Massachusetts	Washington
Montana	
ASHRAE 90.1-2016 or Equivalent (3 states)	
Florida	New York
Louisiana	
ASHRAE 90.1-2013 or Equivalent (17)	
Alabama	Nevada
Delaware	New Hampshire
Georgia	New Mexico
Hawaii	Pennsylvania
Idaho	Rhode Island
Illinois	Texas
Maine	Virginia
Michigan	West Virginia
Nebraska	
ASHRAE 90.1-2010 or Equivalent (3)	
North Carolina	Minnesota
Wisconsin	
At or Below Current HUD and USDA Standard (17)	
ASHRAE 90.1-2007 or Equivalent (7)	
Arkansas	Ohio
Iowa	South Carolina
Indiana	Tennessee
Kentucky	
No Statewide Code (8)	
Alaska	Missouri (Home Rule)
Colorado (Home Rule)	North Dakota (Home Rule)
Kansas (Home Rule)	South Dakota (Home Rule)
Mississippi	Wyoming (Home Rule)
Equivalent to Less Than ASHRAE 90.1-2007 (2)	
Arizona (Home Rule)	Oklahoma
U.S Territories	
Guam 2018 IBC	N. Mariana Islands 2018 IBC
Puerto Rico IBC 2018 (amended)	American Samoa N/A
U.S. Virgin Islands 2018 IBC	

Figure 3. ASHRAE 90.1 Adoption Map Mid-Rise and High-Rise Multifamily (Status as of December 2023)



4. Analysis of Adopted State Energy Codes for Commercial Buildings

As with residential buildings, the Department of Energy assesses the energy code adopted by each state for commercial buildings. This analysis can be found in the ''commercial state-level results'' available for download at *https://www.energycodes.gov/state-portal.* The analysis presents the energy index for each state-adopted code, including any amendments, as well as each version of ASHRAE 90.1. A comparison of the energy index for the amended codes to that of their code efficiency category demonstrates the impact of each amendment on energy efficiency.

5. Impacted Multifamily Housing

Table 24 provides the estimated number of new mid-rise or high-rise multifamily units that are estimated to be impacted annually by the proposed Determination on ASHRAE 90.1–2019. Using a three-year average (2019 to 2021) annual production for each program, HUD preliminarily estimates that a total of approximately 15,000 new mid-or high-rise multifamily units (four or more stories) will be impacted annually in the 40 states that had not yet adopted ASHRAE 90.1–2019. This includes approximately 11,900 FHA-insured multifamily units, 300 public housing units, and 2,000 HOME- and 300 HTF-financed units. No USDA-guaranteed multifamily units are impacted since these are not covered under this notice.

Table 24. High-Rise Multifamily Units Potentially Impacted by ASHRAE 90.1-2019

State	PIH	HOME	Housing Trust Fund	RAD	FHA Multifamily	Total
AK	0	18	13	25	0	56
AL	34	29	0	0	207	270
AR	0	67	8	16	105	196
AZ	0	58	0	38	278	374
CA (2019)	8	378	0	12	107	505
CO	8	72	0	10	440	530
CT (2019)	15	22	0	0	81	118
DC (2019)	7	0	0	0	89	96
DE	0	2	0	48	0	50
FL	94	124	56	21	953	1248
GA	21	80	0	0	513	614
HI	2	0	0	0	0	2
IA	0	3	3	0	0	6
ID	0	25	17	73	7	122
IL	22	56	0	0	260	338
IN	0	60	0	0	32	92
KS	0	4	19	0	36	59
KY	0	34	0	2	122	158
LA	8	105	1	3	80	197
MA (2019)	0	9	0	35	316	360
MD (2019)	0	77	0	0	547	624
ME	0	21	19	24	10	74
MI	11	54	0	0	65	130
MN	2	73	0	5	391	471
MO	0	138	1	0	286	425
MS	0	0	0	0	0	0
MT (2019)	0	19	2	21	44	86
NC	4	79	0	0	852	935
ND	0	17	8	0	0	25
NE	0	0	0	0	191	191
NH	0	33	4	46	69	152

State	PIH	HOME	Housing Trust Fund	RAD	FHA Multifamily	Total
NJ (2019)	27	75	0	0	32	134
NM	0	5	9	12	74	100
NV	3	216	2	1	59	281
NY	10	156	0	27	932	1125
OH	7	83	0	0	68	158
OK	0	0	7	10	52	69
OR (2019)	0	92	8	30	24	154
PA	27	45	0	0	54	126
RI	0	2	15	2	23	42
SC	0	10	0	0	152	162
SD	0	63	47	37	8	155
TN	1	9	16	103	484	613
TX	54	114	36	0	4,310	4514
UT (2019)	0	1	0	17	307	325
VA	8	38	9	0	596	651
VT (2019)	0	38	16	0	5	59
WA (2019)	10	47	4	31	266	358
WI	4	41	0	0	111	156
WV	0	5	6	5	46	62
WY	0	10	1	0	12	23
Territories						
Puerto Rico	41	86				127
Total	**428**	**2,793**	**327**	**645**	**13,696**	**17,889**
40 states	320	1,949	297	499	11,878	14,943

B. ASHRAE 90.1–2019 Affordability Analysis

1. Cost Benefit Analysis

In its Final Determination of improved energy efficiency for commercial buildings, including multifamily buildings, DOE completes both a ''qualitative'' analysis and a ''quantitative'' analysis to assess increased efficiency of ASHRAE Standard 90.1.[153] In addition to a quantitative and qualitative analysis of the new code, PNNL publishes a cost benefit analysis of each of the codes, which considers the added, or incremental cost for the new standard. In addition, PNNL has published its methodology for evaluating the cost-effectiveness of commercial energy code changes, including multifamily buildings, and that methodology is used by HUD and USDA for this determination.[154] For more detail on the methodology developed by DOE for their cost-benefit analysis, see PNNL's 2015 cost-effectiveness report.[155]

Evaluating cost-effectiveness requires three primary steps: (1) evaluating the energy and energy cost savings of code changes, (2) evaluating the incremental and replacement costs related to the changes, and (3) determining the cost-effectiveness of energy code changes based on those costs and savings over time. The DOE methodology estimates the energy impact by simulating the effects of the code change(s) on typical new buildings, assuming both old and new code provisions are implemented fully and correctly. The methodology does not estimate rates of code adoption or compliance. Cost-effectiveness is defined primarily in terms of LCC evaluation, although the DOE methodology includes several metrics intended to assist states considering adoption of new codes.

2. Building Prototypes

The basis for DOE's ASHRAE 90.1 cost-benefit analysis are16 prototype building models representing different commercial sector building types. Of the 16 prototypes modeled by DOE, two are multifamily buildings-a 4-floor mid-rise apartment building and a 10-floor high-rise apartment building. Table 25 provides detailed characteristics of the mid-rise prototype.

[153] 86 FR 40543 (July 28, 2021), *Final Determination Regarding Energy Efficiency Improvements in ANSI/ASHRAE/IES Standard 90.1-2019, https://www.govinfo.gov/content/pkg/FR-2021-07-28/pdf/2021-15971.pdf.*

[154] PNNL, *Methodology for Evaluating Cost-Effectiveness of Commercial Energy Code Changes,* January 2015, *https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-23923.pdf.*

[155] Ibid.

Table 25. Mid-Rise Apartment Building Prototype Characteristics[156]

GENERAL	
Building Type	Multifamily residential building
Gross Floor Area	33,700 sf
Building Shape	Rectangle
Aspect Ratio	2.75 (152 ft x 56 ft)
Number of Floors	4
Activity Area	Each floor has 8 (25'x38') apartments, except ground floor which has 7 apartments and one lobby/office
Window-to-Wall Ratio	15% (4ft high view windows)
Floor Height	10 ft
Floor-to-Ceiling Height	10 ft (for the office area only)
Exterior Wall	Steel-framed wall
Roof	Insulation entirely above deck, metal deck roof
Floor	8" Slab-on-grade
INTERNAL LOADS	
Occupancy	
Number of People	78 persons total (average 2.5 persons per apartment unit)
Lighting	
Average Power Density	• Apartment units: 0.36 w/sf
	• Corridors: 0.5 w/sf
	• Office area: 1.1 w/sf
Plug Load	
Average Power Density	0.62 w/sf
HVAC	
Heating Type	Gas furnace
Cooling Type	Split system DX (one per apartment)
Fan Control	Constant volume
Distribution/Terminal Units	Single zone/direct air
Cooling T-stat	75°F (no setback assumed)
Heating T-stat	70°F (no setback assumed)
WATER HEATER	
Water Heater Type	Individual residential electric storage water heater
Tank Capacity, gallons	20 (per apartment unit)
Supply Temperature, °F	120

3. ASHRAE 90.1–2019 Incremental Costs

Table 26 provides annual cost savings, added construction costs, and net LCC savings for the mid-rise multifamily prototype building.[157] Cost estimates typically use current national average prices. Labor costs are based on estimated hours and current crew labor rates from RS Means. In some cases, cost estimates completed for a prior code cycle are still applicable and are adjusted for inflation rather than creating a new cost estimate or obtaining current unit prices throughout the cost estimate. Where cost estimates are updated, inflation factors specific to the equipment are used. These inflation factors are developed for each specific equipment or insulation type by comparing RS Means from the time of the estimate with the current RS Means.

[156] PNNL, *Impacts of Standard 90.1–2007 for Commercial Buildings at State Level, https://www.pnnl.gov/main/publications/exter00nal/technical_reports/PNNL-18544.pdf.*

[157] Special tabulation provided by DOE/PNNL to HUD of costs and savings for mid-rise multifamily buildings only, 9/2/21.

Added construction costs average $574/building, or just $18/unit. This low average per-unit increase in cost is because in two of the climate zones analyzed, construction costs are expected to be lower for ASHRAE 90.1–2019 relative to the USDA-HUD 2007 baseline: construction costs for ASHRAE 90.1–2019 are projected to decrease by $257/unit in Climate Zone 2A, and by $142/unit in Climate Zone 4A. Conversely, the highest increase is projected to be $285/unit in Climate Zone 3B, followed by $274 per unit in Climate Zone 3A. Added or incremental construction cost can be negative for some building types for some of the following reasons:

- Fewer light fixtures are required when the allowed lighting power is reduced. Also, changes from fluorescent to LED technology result in reduced lighting costs in many cases and longer lamp lives, requiring fewer lamp replacements.
- Smaller heating, ventilating, and air-conditioning (HVAC) equipment sizes can result from the lowering of heating and cooling loads due to other efficiency measures, such as better building envelopes. For example, Standard 90.1–2019 has more stringent fenestration U-factors for some climate zones. This results in smaller equipment and distribution systems, resulting in a negative first cost.[158]

Annual energy cost savings average $7,153 per building, or $224 per unit, yielding LCC savings of an estimated $188,337 per building or $5,886 per unit. Simple paybacks are immediate in two of the five climate zones analyzed, and 0.4 to 1.5 years in the remaining climate zones, resulting in an extremely fast average payback of just 0.1 years.

Table 26. ASHRAE 90.1-2019 Added Costs and Savings – National (2021 dollars) (2019 Edition vs. 2007 Baseline)

	Per Square Foot			
Climate Zone	Annual Cost Savings, $/ft²	Added Construction Cost, $/ft²	Net LCC Savings, $/ft²	Simple Payback Years
2A	0.253	-0.244	6.37	Immediate
3A	0.213	0.260	5.42	1.2
3B	0.186	0.270	4.89	1.5
4A	0.206	-0.135	5.68	Immediate
5A	0.207	0.075	5.44	0.4
National Weighted Average	0.212	0.017	5.58	0.1

	Per Building			Per Unit		
Climate Zone	Annual Savings $/bldg.	Added Construction Cost, $/bldg.	Net LCC Savings $/bldg.	Annual Savings $/unit	Added Construction Cost, $/unit	Net LCC Savings $/unit
2A	8,536	(8,233)	214,924	267	-257	6,716
3A	7,187	8,772	182,871	225	274	5,715
3B	6,276	9,110	164,989	196	285	5,156
4A	6,950	(4,555)	191,643	217	-142	5,989
5A	6,984	2,531	183,546	218	79	5,736
National Weighted Average	7,153	574	188,337	224	18	5,886

4. State-Level Results

Table 27 provides multifamily added costs and savings for ASHRAE 90.1–19 over the 2007 edition for individual states.[159] Most states (38 states plus the District of Columbia) show lower per-unit added costs for adoption of ASHRAE 90.1–2019 compared to the 2007 standard. Incremental cost savings per unit range from a low of $44 in Illinois to a high of $347 in Delaware. Only 13 states show increased incremental costs: Alabama, Georgia, Mississippi, North Carolina, Nevada, Oklahoma, South Carolina, South Dakota, Tennessee, and Wisconsin. For these 10 states, increased costs average $169/unit, ranging from $22/unit in Nevada to $297/unit in South Dakota. The average incremental cost for all states is just −3/unit.

[158] See, for example, PNNL: *https://www.energycodes.gov/sites/default/files/2021-07/Cost-effectiveness_of_ASHRAE_Standard_90-1-2019-NorthCarolina.pdf.*

[159] Ibid., DOE/PNNL Special Tabulation provided to HUD 9/2/21. Note that many states have already adopted more recent versions of the code than ASHRAE 90.1–2007. As a result, actual costs and savings can both be expected to be lower for those states.

Table 27. ASHRAE 90.1-2019 Added Costs and Savings – States (2021 dollars)

State	Current Code	Incremental Cost $/Unit	Energy Cost Savings $/bldg/yr	Energy Cost Savings, $/unit/yr	Net LCC Savings, Scenario 1 (Publicly-Owned), $/unit	Net LCC Savings, Scenario 2 (Privately-Owned), $/unit	Simple Payback (Years)
AK	No Code	(319)	7,828	245	9,652	8,604	Immediate
AL	2013	210	10,493	328	6,275	5,705	0.9
AR	2007	(23)	5,736	179	5,321	4,835	Immediate
AZ	Home Rule	(234)	5,702	178	6,466	5,938	Immediate
CA	2019	-	-	-	-	-	-
CO	No Code	(72)	6,208	194	5,630	5,201	Immediate
CT	2019	-	-	-	-	-	-
DC	2019	-	-	-	-	-	-
DE	2013	(347)	6,208	194	6,537	5,778	Immediate
FL	2013	(127)	5,871	183	6,657	6,039	Immediate
GA	2013	229	9,515	297	5,693	5,213	1.1
HI	Home Rule	(297)	5,938	186	11,457	10,357	Immediate
IA	2007	(117)	5,601	175	5,975	5,458	Immediate
ID	2013	(60)	7,592	237	5,135	4,698	Immediate
IL	2013	(44)	8,536	267	6,450	6,028	Immediate
IN	2007	(182)	5,770	180	6,527	5,970	Immediate
KS	No Code	(308)	5,972	187	6,655	6,113	Immediate
KY	2007	(328)	9,211	288	5,947	5,377	Immediate
LA	2007	(172)	6,782	212	6,237	5,627	Immediate
MA	2019	-	-	-	-	-	-
MD	2019	-	-	-	-	-	-
ME	No Code	(56)	4,994	156	7,160	6,461	Immediate
MI	2013	(88)	6,782	212	6,475	5,978	Immediate
MN	2010	(54)	7,659	239	6,915	6,271	Immediate
MO	No Code	(333)	7,457	233	6,434	5,902	Immediate
MS	No Code	161	8,199	256	5,985	5,527	0.7
MT	2019	-	-	-	-	-	-
NC	2010	157	4,859	152	5,125	4,699	0.9
ND	No Code	(57)	6,276	196	6,220	5,584	Immediate
NE	2013	(124)	7,085	221	5,546	5,072	Immediate
NH	2010	(6)	7,018	219	7,022	6,394	Immediate
NJ	2019	-	-	-	-	-	-
NM	2013	(305)	7,794	244	5,807	5,300	Immediate
NV	2013	22	6,613	207	5,150	4,758	0.1
NY	2016	(305)	6,917	216	8,454	7,754	Immediate
OH	2007	(192)	6,984	218	6,151	5,640	Immediate
OK	No Code	150	7,389	231	5,330	4,836	0.8
OR	2019	-	-	-	-	-	-
PA	2013	(256)	5,061	158	6,524	5,811	Immediate
PR	2010	0	8,098	253	-	-	0.0
RI	2007	(200)	5,668	177	8,171	7,518	Immediate
SC	2007	186	6,276	196	5,684	5,221	0.9
SD	No Code	297	6,343	198	5,359	4,945	1.6
TN	2007	118	5,061	158	6,086	5,525	0.5
TX	2013	(155)	6,276	196	5,581	5,182	Immediate
UT	2019	-	-	-	-	-	-
VA	2013	(275)	6,006	188	5,297	4,754	Immediate
VT	2019	-	-	-	-	-	-
WA	2019	-	-	-	-	-	-
WI	2010	59	5,027	157	6,400	5,909	0.3
WV	2010	(96)	6,343	198	6,093	5,479	Immediate
WY	No Code	(180)	5,736	179	5,952	5,426	Immediate
Average		(93)	6,670	208	6,388	5,822	Immediate

Key: No Code=No statewide code; Home Rule = Home Rule state.

All states show energy cost savings, both those with incremental cost increases and those that show lower incremental costs. Annual energy cost savings average $208/unit, ranging from $152/unit (North Carolina) to $328/unit

(Alabama). For the prototype 32-unit mid-rise building, this translates into an average annual cost savings of $6,670/building, ranging from $4,859 annual cost savings in North Carolina to $10,493 in Alabama.

The annual energy cost savings relative to lower incremental costs in many states yield ''negative'' simple paybacks in these states; where that is the case, Table 27 shows these paybacks as ''immediate.'' Average simple payback for all states is immediate. The states showing lower incremental costs show immediate paybacks: For example, Ohio shows a decrease in first costs of $192 per unit, but annual energy cost savings of $218, in which case the payback on this investment is immediate.

Table 27 also shows life cycle cost savings for this investment. Average Life Cycle Cost savings for privately owned buildings are $5,822/unit, with LCC savings estimated to be highest in Hawaii ($10,357 per building) and lowest in Idaho ($4,698 per building).

5. Total Life Cycle Cost Savings

Table 28 shows total estimated LCC Savings for ASHRAE 90.1–2019 relative to ASHRAE 90.1–2007. For the total estimated units that could be impacted by the adoption of this code, incremental costs will be an estimated $1.49 million lower than the cost of construction to the 2007 baseline. Annual energy cost savings are estimated to be $3.1 million, and national LCC savings $83.4 million for privately owned buildings. Costs and savings for states that have already adopted the 2019 standard are excluded from these totals, on the assumption that housing will already be built to this standard, and no additional costs will be incurred or savings realized. Additionally, states that have adopted a more recent version than ASHRAE 90.1–2007 are expected to see reduced costs as well as reduced savings compared to the analysis that relies on ASHRAE 90.1–2007 as a baseline.

Table 28. Total Life Cycle Savings – States (2021 dollars)
(ASHRAE 90.1-2019 against 90.1-2007 Baseline)

State	Total Units	Annual Energy Cost Savings, $/state	Added Construction Cost, $/state	Net LCC Savings, Scenario 1 (Publicly-Owned), $/state	Net LCC Savings, Scenario 2 (Privately-Owned), $/state	Simple Payback (Years)
AK	56	18,363	(17,891)	540,498	481,807	Immediate
AL	270	66,046	56,652	1,694,138	1,540,410	0.9
AR	196	35,132	(4,546)	1,043,000	947,731	Immediate
AZ	374	87,148	(87,543)	2,418,464	2,220,902	Immediate
CA	505	-	-	-	-	-
CO	530	94,440	(38,000)	2,984,092	2,756,653	Immediate
CT	118	-	-	-	-	-
DC	96	-	-	-	-	-
DE	50	9,700	(17,344)	326,856	288,899	Immediate
FL	1,248	319,754	(157,903)	8,308,340	7,537,246	Immediate
GA	614	129,477	140,483	3,495,238	3,200,678	1.1
HI	2	922	(595)	22,914	20,714	Immediate
IA	6	1,164	(702)	35,851	32,751	Immediate
ID	122	18,523	(7,332)	626,446	573,192	Immediate
IL	338	66,286	(14,968)	2,179,969	2,037,417	Immediate
IN	92	20,371	(16,781)	600,445	549,228	Immediate
KS	59	12,939	(18,165)	392,658	360,683	Immediate
KY	158	28,987	(51,810)	939,575	849,615	Immediate
LA	197	44,658	(33,857)	1,228,616	1,108,558	Immediate
MA	360	-	-	-	-	-
MD	624	-	-	-	-	-
ME	74	18,023	(4,135)	529,859	478,130	Immediate
MI	130	28,099	(11,377)	841,739	777,180	Immediate
MN	471	102,798	(25,327)	3,256,772	2,953,840	Immediate
MO	425	83,348	(141,603)	2,734,363	2,508,516	Immediate
MS	0	-	-	-	-	-
MT	86	-	-	-	-	-
NC	935	168,579	146,890	4,792,171	4,393,892	0.9
ND	25	4,903	(1,423)	155,494	139,599	Immediate
NE	191	33,430	(23,764)	1,059,288	968,665	Immediate
NH	152	38,464	(962)	1,067,365	971,847	Immediate
NJ	134	-	-	-	-	-
NM	100	17,714	(30,471)	580,750	530,034	Immediate
NV	281	44,442	6,222	1,447,028	1,337,109	0.1
NY	1,125	300,101	(342,804)	9,510,726	8,723,108	Immediate
OH	158	31,319	(30,320)	971,893	891,097	Immediate
OK	69	12,877	10,331	367,761	333,713	0.8
OR	154	-	-	-	-	-
PA	126	24,710	(32,283)	822,084	732,143	Immediate
PR	127	-	-	-	-	0.0
RI	42	12,089	(8,414)	343,199	315,743	Immediate

State	Total Units	Annual Energy Cost Savings, $/state	Added Construction Cost, $/state	Net LCC Savings, Scenario 1 (Publicly-Owned), $/state	Net LCC Savings, Scenario 2 (Privately-Owned), $/state	Simple Payback (Years)
SC	162	34,333	30,062	920,830	845,845	0.9
SD	155	29,090	46,087	830,705	766,478	1.6
TN	613	137,669	72,389	3,730,628	3,386,779	0.5
TX	4,514	875,739	(699,639)	25,191,762	23,392,691	Immediate
UT	325	-	-	-	-	-
VA	651	101,587	(179,150)	3,448,464	3,094,969	Immediate
VT	59	-	-	-	-	-
WA	358	-	-	-	-	-
WI	156	33,061	9,211	998,409	921,760	0.3
WV	62	12,290	(5,949)	377,780	339,669	Immediate
WY	23	4,123	(4,147)	136,895	124,794	Immediate
National	17,889	3,102,699	(1,490,877)	90,953,068	83,434,084	Immediate

The Regulatory Impact Analysis at *www.regulations.gov* provides a more granular analysis of the estimated cost benefits associated with building to the ASHRAE 90.1–2019 standard, taking into account each state's current baseline code. Using current state baselines, Table 29 (also RIA Figure 30) estimates a total incremental cost savings of $9.2 million, and a LCC savings of $44.1 million (at a 3 percent discount rate).

Table 29. Incremental Costs and Energy Savings Resulting from Adoption of ASHRAE 90.1-2019 (2021 dollars)

Current ASHRAE 90.1 Standard	Number of States	Annual Number of Units Affected*	Total Incremental Costs	Net Present Value of Energy Savings	
				3% Discount Rate	7% Discount Rate
No Statewide Code	10	1,596	-$662,487	$21,397,225	$14,072,666
2007	7	1,264	-392,015	5,460,546	3,591,328
2010	3	1,557	-594,671	4,027,640	2,648,924
2013	17	7,508	-6,613,942	11,338,502	7,457,180
2016	3	2,519	-983,227	1,894,844	1,246,214
2019	11	2,673	0	0	0
Total	**51**	**17,117**	**-$9,246,342**	**$44,118,757**	**$29,016,311**

C. Final Affordability Determination—ASHRAE 90.1–2019

In light of the significant estimated savings, both annual and LCC savings, and the nominal cost increase shown in Tables 27 and 28, HUD and USDA have determined that the adoption of ASHRAE 90.1–2019 will not negatively impact the affordability of the multifamily housing covered by this notice. As shown in Table 27, the national average incremental cost for adoption of this edition is −3/unit, while the annual energy cost savings per unit averages $208/unit. In all but 10 states, the incremental costs of building to this standard have in fact decreased, not increased, relative to the current HUD and USDA ASHRAE 90.1–2007 standard: in none of these states is the added construction cost more than $297/unit, and in that state (South Dakota), annual energy cost savings are estimated to be $198/year, yielding a rapid Simple Payback of just 1.6 years. Average (unweighted) payback for all states is immediate, with 10 states having payback period of up to 1.6 years. Estimated first costs are also a nominal fraction of total construction costs: the weighted national average of 0.017 $/sf (less than two cents) in added costs represents just 0.16 percent of the estimated total building cost of $218/sf. Finally in every state analyzed, the net LCC savings are positive, with a weighted national average of $5,822 for privately owned buildings.

V. Impact on Availability of Housing

EISA requires that HUD and USDA assess both the affordability and availability of housing covered by the Act. This section of this notice addresses the impact that the EISA requirements would have on the ''availability'' of housing covered by the Act. ''Affordability'' is assumed to be a measure of whether a home built to the updated energy code is affordable to potential homebuyers or renters, while ''availability'' of housing is a measure associated with whether builders will make such housing available to consumers at the higher code level; *i.e.,* whether the higher cost per unit as a result of complying with the revised code will impact whether that unit is

likely to be built or not. A key aspect of determining the impact on availability is the proportion of affected units in relation to total units funded by HUD and USDA or total for sale units. These issues are discussed below.

A. 2009 IECC—Single Family

In its 2015 Final Determination adopting the 2009 IECC, HUD concluded ''[t]hough both higher construction costs and hedonic increases in demand for more energy-efficient housing are expected to contribute to an increase in housing prices or contract rents, HUD and USDA do not project such higher prices to decrease the quantity of affordable housing exchanged in the market.'' [160]

The current proposed update of IECC requirements constitutes a more expansive impact. The per unit cost is greater than for the previous rule. Revised estimate of the upfront cost of building to 2021 IECC is approximately $7,229, ranging from a low upfront incremental cost of $3,662 in Climate Zone 1 to a high of $8,845 in Climate Zone 8. Likewise, the geographic scope of the impact of the proposed rule is also more extensive than in 2015. In 2015, construction only in those 16 states that had not yet adopted the 2009 IECC or its equivalent was directly affected. Conversely, only five jurisdictions have adopted a standard that meets or exceeds the 2021 IECC requirements. Under this notice, more than 100,000 newly built units would have to comply with the 2021 IECC standard, compared to an estimate of 11,500 annually for the 2015 notice that required IECC 2009 as a minimum standard. This merits a more detailed discussion of the potential impacts on the availability of housing to program participants as well as the housing market overall. As set forth in this section of this notice, HUD and USDA find that there would be no noticeable impact on the supply of housing covered by this notice; there are many ways for both homebuyers and builders to address the costs of the notice if buying or building to the 2021 IECC is not advantageous; but, under very specific conditions, availability could be constrained.

The focus of this availability analysis is on the purchase of newly built homes by FHA-insured borrowers. While other covered programs are important, FHA-insured single family purchases represent the overwhelming majority of units that would be affected by final adoption of the proposed standards. Homebuyers and builders of single family homes will be more sensitive to the IECC requirement than renters and builders affected by the ASHRAE 90.1 update because the estimated incremental cost for single family homes is greater than the incremental cost of updating ASHRAE 90.1.

1. Builder Impacts

Builders are required to build to the 2021 IECC standard only if they wish to sell the new home to a borrower who has a mortgage insured by FHA or guaranteed by USDA. If builders predict that the construction costs outweigh the expected private benefits of building to the 2021 IECC standard, then the supply of newly built homes for FHA-financed borrowers could contract. However, one of several incentives for builders to build to the 2021 IECC standard is to preserve FHA-insured borrowers as potential customers.

FHA-insured borrowers can be a large portion of potential buyers of new construction in some markets. As shown below, in 2020, FHA-insured loans financed just one percent of the purchases of newly built homes in the Northeast, 8.3 percent in the Midwest, 11.0 percent in the West, and a significantly higher market share of 24.5 percent of purchases in the South.

The regions where construction activity is high (*e.g.,* South and West) are also areas where a higher share of buyers of new construction are FHA-insured. In such markets, builders would be more inclined to build to the energy code required by this notice. Having more potential customers increases competition for a home and would reduce the opportunity costs of time on market.

Table 30. Type of Financing of New Single Family Homes (Homes Sold in the United States, 2020)

	Thousands of Homes					Percent Financed			
	Conventional	FHA	VA	Cash	Total	Conventional	FHA	VA	Cash
Northeast	25	(Z)	1	2	28	89.3	**1.0**	3.6	7.1
Midwest	60	6	2	4	72	83.3	**8.3**	2.8	5.6
South	244	96	31	21	392	62.2	**24.5**	7.9	5.4
West	128	19	18	8	173	74.0	**11.0**	10.4	4.6
U.S.	457	122	52	35	665	68.6	**18.3**	7.8	5.3

Source: Annual Characteristics of New Housing, U.S. Census
Z = Less than 500 units or less than 0.5 percent.

The cost to a developer of adopting the standard includes the added building costs, loss of potential customers unwilling to pay the additional price, and any other distortions in design introduced by the regulation. The builder can reasonably be expected to build an affordable home to the 2021 IECC standard if: FHA-insured borrowers are a significant part of the market for newly built homes; there is a sufficient market return from energy efficiency; and the builder is able to pass on some of the cost to the buyer. Under these conditions, which will vary by climate zone and the state of the housing market, availability is not likely expected to be adversely affected. Conversely, builders may be discouraged from building to the higher standard if FHA-insured borrowers are a limited share of the market for new homes, *e.g.,* in the Northeast, where only 1 percent of all new homes are

[160] 80 FR 25901 at 25918 (May 6, 2015).

FHA-financed. However, the impact would be limited because the number of homes likely impacted would be close to zero and, more importantly, there are already states in the Northeast considering adoption of the 2021 or 2024 IECC standards.

A second possibility is that the builder continues to build affordable homes but not to the 2021 IECC. This would be the case when and where there are significant profits from building new homes for low-income homebuyers, even if not FHA-insured, FHA-insured borrowers are not a major part of the market, perhaps because conventional loans are relatively more affordable, the unlikely case that lower-income homebuyers do not place a significant premium on energy efficiency, or the builder is unable to pass on costs to the buyer. Under this scenario, the total supply of affordable housing would not necessarily be adversely affected, but new construction for FHA borrowers could decline. A third possibility is that the profit margin from building affordable housing is so slim that any change to the market could lead to different development decisions. One alternative may be for builders to build housing for higher-income buyers. This strategy could place the home out of reach of some FHA-insured borrowers and thus reduce the availability of some affordable housing. However, in both of these cases, the impact is expected to be limited: estimates of the impact on availability in the price elasticity model shown below indicate the impacts are likely to be limited to an extremely small share of housing supply (0.2 percent of all homes available to FHA-insured home buyers). For further and more detailed discussion of different availability scenarios, see the Regulatory Impact Analysis, Section 10.2 New Construction, Housing Supply, and Availability of Housing.

2. Single Family Market Impacts

The change in market quantity depends not only on the decisions of builders and the real estate industry more broadly but also on the willingness of buyers to absorb a price change. The percentage reduction of quantity is greater as demand and supply are more responsive to price changes and as the incremental cost constitutes a larger portion of the sales price.

The impact on availability, as measured by the quantity of housing, would be given by:

$$\frac{\Delta Q}{\mathrm{Q}} = \left(\frac{E_S \cdot E_D}{E_S - E_D}\right) \cdot \left(\frac{\Delta C}{P}\right)$$

The percentage change in the quantity of housing, $\Delta Q/Q$, depends on the price elasticity of demand E_D (the percentage change in quantity demanded from a percentage change in price), the price elasticity of supply E_S, and the incremental cost ΔC, as a fraction of the pre-regulation sales price P. The percentage reduction of quantity is greater as demand and supply are more responsive to price changes (more price elastic), and the incremental cost constitutes a larger portion of the sales price before the introduction of the cost.[161]

Estimates from studies of the price elasticities of demand and supply vary due to differences in methods, data, and geographies and time periods examined. Generally, the estimate of the price elasticity of demand for housing is below -1, as low as -0.2 for low-income households, but has been estimated to be above -1. Generally, lower income households have a lower measured price elasticity of demand for housing. The positive association between income and the absolute value of price elasticity stems from shelter being a necessary good.[162]

The price elasticity of supply and demand has been estimated at a wide variety of levels for different housing markets, primarily due to differences in the ease of building additional units, depending on the metropolitan area, neighborhood and even type of housing.[163] The incremental cost of adopting the 2021 IECC is expected to be approximately 2 percent of the pre-regulation sales price (a $7,229 incremental cost and $363,000 sales price). Our most cautious estimate is that the approximately 2 percent increase in construction cost would reduce the production of homes for FHA-insured borrowers by 1.5 percent, which represents a 0.2 percent reduction of all homes available to FHA-insured homebuyers.

This estimate is considered a ''worst-case'' scenario because it does not account for any of the positive effects of energy-efficiency. Any adverse impacts on availability would be diminished when there is a perceptible demand for energy-efficient homes.

It is important to note that there would be no adverse effects on the broader availability of housing options for FHA-insured homebuyers if they are able to find close substitutes in other submarkets. Close substitutes may include, for example, relatively new existing housing or code-complaint new homes in adjacent or nearby communities with similar features or amenities. Finding a close substitute may be more difficult in rural areas where there is less available housing stock. USDA guaranteed and direct loans are limited to eligible areas as defined by USDA and exclude central cities. Thus, there could be a greater relative burden on Section 502 guaranteed loans: about half of USDA's guaranteed and direct home loans are to borrowers in rural areas as defined by the 2010 Census as compared to about one-fifth of FHA-insured mortgages (AHS, 2019).

However, adoption of the new code is not expected to have spillover impacts on other housing submarkets given the relatively small size of the directly affected FHA and USDA submarkets. The purchase of new homes by FHA-insured borrowers represents only 2.3 percent of all residential sales in 2020. As a portion of all home purchases (all homebuyers, new and existing homes), FHA-financed purchases of new construction range from slightly more than 0 percent in the Northeast to slightly less than 3.6 percent in the South.

Energy efficiency has also been shown to impart an economic value to buildings. The willingness to pay for this benefit will vary among homebuyers. If there is a sufficient proportion who expect to realize those gains, then there will be a demand for housing built to the 2021 IECC that could partially counteract any adverse impacts on availability. See the discussions in the Regulatory Impact Analysis at *www.regulations.gov* in the ''Capitalization of Energy Efficiency Standard'' section (p.86).

[161] The pass-through rate is the proportion of the cost paid by buyers, which is higher as demand is less price elastic and supply is more price elastic.

[162] Mayo (1981) shows this to be the case when a household must consume a minimum amount of housing (a Stone-Geary utility function).

[163] Gyourko and Saiz (2006) attribute the local variation in construction activity to more than the cost of materials but also to local wages, local topography, and the local regulatory environment.

Empirical studies cited in the RIA suggest there is a statistically significant and positive influence of energy efficiency on real estate values of energy efficient housing.[164] One study examining the residential market in California found that a green label adds about 2.1 percent to the value of a home. This premium is slightly above the costs of bringing a home in compliance with the green labels (Energy Star, LEED, and EnergyPoint).

Another study examined the premium placed on the Energy Star certification on homes in Gainesville, Florida and found that there is a premium for these homes but that the premium diminishes when the home is resold; this finding could suggest that energy efficiency is a motivator for buying newly built homes.[165] Another two studies examined the effects of a label, which would be a voluntary option for the builder, rather than a code, which is obligatory.[166] In another study, researchers found that energy performance certificates do not play a role in determining market value but that energy efficiency itself is capitalized into housing sales prices (about 2 percent for every 10 percent reduction of energy consumption).[167]

A survey by the National Association of Home Builders found that the median borrower was willing to pay an extra $5,000 upfront to save $1,000/year in utility bills.[168] This tradeoff would be equivalent to the resident receiving 10 years of benefits at a 20 percent discount rate or 30 years of benefits at 25 percent discount rate. A recent survey of the National Association of Realtors found that sixty five percent of realtors believed that energy efficiency was valuable in promoting residential units. (However, the majority of realtors (57 percent) were ''not sure'' as to the impact of energy efficiency on sales price.) [169]

A study of commercial buildings showed that a studio with an Energy Star certification will rent for about 3 percent more per square foot and sell for as much as 16 percent more. The authors were able to disentangle the value of the label itself from the value of energy savings stemming from increased energy efficiency. Energy savings were important: a 10 percent decrease in energy consumption led to an increase in value of about one percent over and above the rent and value premium for a labeled building.[170]

All of this empirical research shows that there are profit incentives to providing energy efficiency. Such a price gain would diminish any adverse effects on the supply of housing, although it is also evidence that bidding for energy efficiency could reduce affordability.

3. Evidence From Prior (2009 IECC) Code Adoption

Examining FHA new construction loans by the level of a state's energy-efficiency standards can provide a rough indicator of the potential impact of the IECC on availability. Having required a minimum standard equal to the 2009 IECC (in 2015), the purchase of a new FHA-insured or USDA-guaranteed home could depend on the strictness of the state-wide code relative to the 2009 IECC. However, as shown in Table 19, in states where the state-wide standard is lower than that required by HUD and USDA, the proportion of FHA loans for new construction appears similar to states that have adopted stricter codes. For the group where the state-wide code is at least as stringent as the 2009 IECC, the proportion of FHA-insured new construction loans is 16.9 percent, which is slightly higher than the 15.1 percent for the states where energy codes are below IECC 2009. Despite the cyclical nature of new construction, there is no compelling evidence that the availability of newly built owner-occupied housing will be adversely affected.

[164] Laquatra, J., Housing Market Capitalization of Energy Efficiency Revisited, 2002.

[165] Bruegge, C., Deryugina, T. and Myers, E., 2019. The distributional effects of building energy codes. Journal of the Association of Environmental and Resource Economists, 6(S1), pp. S95–S127.

[166] Bruegge et al., 2016; Kahn, Matthew E., and Nils Kok. ''The capitalization of green labels in the California housing market.'' Regional Science and Urban Economics 47 (2014): 25–34.

[167] Aydin, Erdal, Dirk Brounen, and Nils Kok. ''The capitalization of energy efficiency: Evidence from the housing market.'' Journal of Urban Economics 117 (2020): 103243.

[168] Ford, Carmel. ''How Much Are Buyers Willing to Pay for Energy Efficiency?'' Eye on Housing: National Association of Home Builders Discusses Economics and Housing Policy. April 12, 2019. *https://eyeonhousing.org/2019/04/how-much-are-buyers-willing-to-pay-for-energy-efficiency/*.

[169] National Association of Realtors, REALTORS and Sustainability Report—Residential, 2021, *https://www.nar.realtor/sites/default/files/documents/2021-realtors-and-sustainability-report-04-20-2021.pdf*.

[170] Eichholz, P., N. Kok and J. Quigley, ''Doing Well by Doing Good? Green Office Buildings,'' American Economic Review 100:5 (2010): 2492–2509.

Table 31. FHA-Insured Single Family Forward Loans, 2021 Grouped by Region and Strictness of State-wide Standard

All Regions			
State-wide Energy Standard	**New Construction**	**All Purchase Loans**	**Percent New (%)**
Less than IECC 2009	14,800	98,300	15.1
Same as IECC 2009	61,900	445,800	13.9
Higher than IECC 2009	47,000	226,700	21.0
South			
State-wide Energy Standard	**New Construction**	**All Purchase Loans**	**Percent New**
Less than IECC 2009	5,400	32,600	16.6
Same as IECC 2009	49,390	225,000	21.9
Higher than IECC 2009	37,900	116,000	32.7
West			
State-wide Energy Standard	**New Construction**	**All Purchase Loans**	**Percent New**
Less than IECC 2009	8,090	42,275	19.1
Same as IECC 2009	5,490	32,500	16.9
Higher than IECC 2009	9,050	73,900	12.3
Midwest			
State-wide Energy Standard	**New Construction**	**All Purchase Loans**	**Percent New**
Less than IECC 2009	1,310	23,400	5.6
Same as IECC 2009	5,650	122,000	4.6
Higher than IECC 2009	165	3,270	5.1
Northeast			
State-wide Energy Standard	**New Construction**	**All Purchase Loans**	**Percent New**
Less than IECC 2009	0	0	---
Same as IECC 2009	1,410	66,000	2.1
Higher than IECC 2009	500	33,660	1.5

There is some regional variation. In the South, the proportion of new construction is much higher in states above the IECC 2009 (32.7 percent) than in states below (16.6 percent). In the West, the proportion of FHA new construction is lower in states with energy codes above the IECC 2009 (12.3 percent) than in states below (19.1 percent). A clear pattern is not identifiable in either the Northeast or Midwest. Diverse climate zones and housing markets could explain why different regions appear to respond differently to the energy standard.

4. Variability in Building Practices in Relation to Energy Codes

Note that there is wide variability in enforcement of, or compliance with, building codes in general. Some states do not adopt statewide building codes, others adopt for only certain building types that may exclude single family housing, some states adopt codes with amendments, while others that have adopted building codes may not enforce them, either in their entirety or only for certain building types.[171]

Conversely, a growing number of builders are incorporating above-code energy efficiency or green building standards that meet or exceed the 2021 IECC as standard building practice. Nearly 2.5 million Energy Star certified single family, multifamily, and manufactured new homes and apartments have been built to date, including more than 140,000 in 2022, representing nearly 10 percent of all U.S. homes built. Homes and apartments that earn Energy Star certification are at least 10 percent more efficient than those built to code. Since 2023, in most states, Version 3.1 of the Energy Star program is the minimum Energy Star standard for single family homes, which is designed to deliver at least 10 percent savings relative to all code versions up to the 2018 IECC. Energy Star Version 3.2 will be implemented in states that adopt the 2021 IECC; Version 3.2 is designed to

[171] Lawrence Berkeley National Laboratory, The Cost of Enforcing Building Codes, Phase I, April 2013. Table 1 shows varying compliance rates: *https://www.researchgate.net/publication/282136731_The_Cost_of_Enforcing_Building_Energy_Codes_Phase_1*.

deliver at least 10 percent energy savings relative to the 2021 IECC.

There are also a smaller number built to the DOE's Zero Energy Ready Home (ZERH) standards. In addition, certain green building standards set Energy Star as a minimum requirement. With the energy efficient new homes tax credit (45L) of up to $2,500 now available for Energy Star Certified Homes and up to $5,000 for DOE Zero Energy Ready Homes for single family homes and, with prevailing wage requirements, up to $2,500 per unit for Energy Star Multifamily New Construction and up to $5,000 per unit for DOE Zero Energy Ready Homes for multifamily homes, the market share for these above-code standards is likely to increase.[172]

There is widespread regional variation in adoption of these standards because they are not typically mandated by municipalities for single family home construction. There are regional variations in above-code standards among builders as well. For example, for Energy Star New Homes, adoption rates in most states are below five percent, with very little in the northeast, while in the southwest the share of Energy Star new homes is much higher, *e.g.,* adoption in Arizona is around 40 percent.[173]

In the multifamily sector, builders frequently build to above code standards such as LEED, Enterprise Green Communities, ICC 700 National Green Building Standard, PHIUS, the Living Building Challenge, or regional programs like Earthcraft. Most of these programs embed Energy Star New Construction within their standards while also addressing other areas of health and disaster resilience requirements. Some municipalities may require one of these above-code standards for new construction of multifamily housing. In the affordable housing sector, each state may also drive the choice of compliance with above-code standards through their Low-Income Housing Tax Credit Qualified Allocation Plans (QAPs). State QAPs may call out these above-code standards specifically or may allocate points to other matching funding streams that incentivize or require specific above-code standards.

B. ASHRAE 90.1–2019—Rental Housing

USDA and HUD have determined that in light of the extremely small incremental first costs, or, in many cases, negative first costs, adoption of ASHRAE 90.1–2019 will not negatively impact the availability of multifamily units financed or insured through these programs. Simple paybacks times are extremely low for the small number of states that will see an increase in first costs, in most cases less than one year. The estimate of the direct cost of construction of moving to this code is not greater than zero. Even if there were a slight increase in construction costs, the estimates of energy savings are sizeable enough such that the benefits would offset the costs for property managers. There could be some builders of multi-family properties who are doubtful of the return and so view the ASHRAE 90.1–2019 requirement as a net burden. For the hesitant developer, there remain other incentives to comply: FHA multifamily loans allow a higher LTV than is common and Low-Income Housing Tax Credits that are frequently used by developers in conjunction with HUD financing often carry a requirement or incentive for energy efficiency. In addition, FHA's lower multifamily Green Mortgage Insurance Premium provides a strong incentive for developers to adopt an above-code standard.

VI. Implementation

Under Section 109(d) of Cranston-Gonzalez (42 U.S.C. 12709), the 2021 IECC and ASHRAE 90.1–2019 standards automatically apply to all covered programs upon the effective date of the specified affordability and availability determinations by HUD and USDA. Accordingly, once a Final Determination has been made by HUD and USDA under section 109(d) (42 U.S.C. 12709(d)) and published, additional notice and comment rulemaking will not be required for the covered programs.

Based on DOE findings on improvements in energy efficiency and energy savings and a subsequent HUD and USDA Final Determination with respect to both housing affordability and availability, HUD and USDA programs specified under EISA will implement procedures to ensure that recipients of HUD and USDA funding, assistance, or insurance comply with the 2021 IECC and ASHRAE 90.1–2019 code requirements, commencing no later than 30 days after the date of publication of a notice of Final Determination. HUD and USDA will take such administrative actions as are necessary to ensure timely implementation of and compliance with the energy codes, to include Mortgagee Letters, notices, notices of Funding Opportunity (NOFOs), Builder's Certification Form HUD–92541, and amendments to relevant handbooks.

In addition, conforming rulemaking will be required to update FHA's single family minimum property standards at 24 CFR 200.926d, Public Housing Capital Fund energy standards at 24 CFR part 905, and HOME property standards at 24 CFR 92.251, although as noted above, this would not entail further notice and comment rulemaking. Similarly, USDA will update minimum energy requirements at 7 CFR part 1924 to conform with the requirements of this notice.

To enable these administrative and conforming rulemaking procedures to be implemented and to provide the industry with adequate time to prepare for these requirements and incorporate them in project plans and specifications, proposals, or applications, adoption of the new construction standards described in this notice will be required as described in Table 32.

In response to public comment and to better enable builders to adapt to these code requirements, the compliance deadlines are extended beyond the dates in the preliminary determination, as shown in Table 32. As discussed in this notice, rural persistent poverty areas, where capacity to adopt above-code standards may be challenging, have a longer compliance timeline. Due to differing administrative procedures associated with each program, compliance dates vary. The compliance dates differ for example, for competitive grant programs that have notices of funds availability or programs, such as FHA-insured multifamily, that provide for pre-applications before firm commitments, compared to application for building permits for single family construction. The compliance dates are as follows:

(1) For FHA-insured multifamily programs, the standards set forth by this notice are applicable to those properties for which mortgage insurance pre-applications are received by HUD 12 months after the effective date of this determination;

(2) For FHA-insured and USDA-guaranteed single family loan programs, the standards set forth by this notice are applicable to new construction where building permits applications will be or have been submitted on or after18 months after the effective date of this determination;

(3) For the HOME and Housing Trust Fund (HTF) programs, the standards set forth by this notice are applicable to residential new construction projects for which HOME or HTF funds are committed by HOME Participating Jurisdictions or HTF grantees on or after

[172] For multifamily homes, the amounts of the 45L tax credit change to up to $500 per unit for Energy Star Multifamily New Construction and up to $1,000 per unit for DOE Zero Energy Ready Homes if prevailing wage requirements are not met.

[173] *https://www.energystar.gov/newhomes/energy_star_certified_new_homes_market_share.*

180 days after the effective date of this notice;

(4) For Public Housing Capital Fund, the standards set forth by this notice are applicable to HUD approvals of development proposals for new Capital Fund or mixed financed projects on or after12 months after the effective date of this determination;

(5) For new construction occurring in higher needs rural areas across all covered programs, the standards set forth by this notice are applicable on or after 24 months after the effective date of this determination. For the purposes of this notice, these are defined as persistent poverty rural areas, as defined by USDA Economic Research Service. This will include persistent poverty counties coterminous with or persistent poverty census tracts located in rural counties as defined by USDA. USDA will publish a map of rural areas covered by this extension no later than 30 days after the effective date of this notice.

Table 32. Compliance Dates for the New Construction Standards in this Notice

Program	Event	Preliminary Determination Compliance Date	Final Determination Compliance Date
HOME and Housing Trust Fund (HTF)	Participating Jurisdiction or HTF Grantee Funding Commitment	180 days after effective date	180 days after effective date
FHA-Insured Multifamily	Pre-application Submitted to HUD	90 days after effective date	12 months after effective date
FHA-Insured Single Family	Building Permit Application	180 days after effective date	18 months after effective date
Public Housing (Capital Fund, Project Based Vouchers)	HUD approvals of development proposals for new Capital Fund or mixed financed projects	180 days after effective date	12 months after effective date
Competitive Grants (Choice Neighborhoods, Section 202, Section 811)	NOFO Publication	N/A	Next published NOFO after effective date.
Rental Assistance Demonstration		Already effective by Federal Register Notice July 27, 2023	Already effective by Federal Register Notice July 27, 2023
USDA Section 502 Guaranteed Housing Loans	Building Permit Application	180 days after effective date	18 months after effective date
USDA Section 502 Direct Loans	Application Selected for Processing	180 days after effective date	18 months after effective date
USDA Section 523 Mutual Self Help Loans	Application Selected for Processing	180 days after effective date	18 months after effective date
All programs, persistent poverty rural areas*	Program-Specific Event, above	N/A	24 months after effective date

*Persistent poverty rural areas across all programs should follow the area-specific implementation guidance rather than that outlined for each HUD and USDA program.

Compliance Paths

HUD and USDA interpret EISA/Cranston-Gonzalez to mean that any energy code that is determined by a DOE or EPA analysis to have an energy efficiency standard that is equal to or more efficient than what is required under the 2021 IECC or ASHRAE 90.1–2019, is deemed to meet the requirements of the 2021 IECC or ASHRAE 90.1–2019, respectively:

(1) EPA's Energy Star Version 3.2 certification for single family and low-rise multifamily buildings, Energy Star Version 1.2 for multifamily new construction, and DOE's Zero Energy Ready Homes Single Family Version 2 certification or Multifamily Version 2, once it is released on January 1, 2025, certification for multifamily buildings will be accepted as evidence of compliance with the standards addressed in this notice:

(2) Certain energy and green building certifications, provided that they require and provide evidence of energy efficiency levels that meet or exceed the 2021 IECC or ASHRAE 90.1–2019 or include certification through EPA's Energy Star Version 3.2 certification for single family and low-rise multifamily buildings, Energy Star Version 1.2 for multifamily new construction, and DOE's Zero Energy Ready Homes Single Family Version 2 certification or Multifamily Version 2 once released, certification for multifamily buildings. These may include standards referenced in one or more HUD or USDA programs,

such as the ICC–700 National Green Building Standard, Enterprise Green Communities, Energy Star Certified New Homes, Energy Star Indoor Air Plus, Leadership in Energy and Environmental Design (LEED), Living Building Challenge, or Passive House, as well as one or more regional or local standards such as Earthcraft, Earth Advantage, or Greenpoint Rated New Home.[174] HUD and USDA will publish a list, to be updated annually, of those standards that comply with the minimum energy efficiency requirements of this notice. HUD and USDA will also accept certifications of compliance of state or local codes or standards for which credible third-party documentation exists that these meet or exceed the 2021 IECC and ASHRAE 90.1–2019.

(3) 2024 IECC (pending publication). The 2024 IECC has preliminarily been estimated by DOE to be at least 6.66 percent more efficient than the 2021 IECC. Adoption of the prescriptive or performance paths of the 2024 IECC will be an allowable compliance pathway, upon publication of a final efficiency determination by DOE that this edition is more energy efficient than the prior code.

[174] Energy Star Certified New Homes Version 3.2 and DOE's Zero Energy Ready Homes set the 2021 IECC as the baseline standard.

VII. Environmental Impact

A Finding of No Significant Impact with respect to the environment was made in connection with the preliminary determination, in accordance with HUD regulations at 24 CFR part 50 and USDA Rural Development regulations at 7 CFR part 1970, which implement section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4332(2)(C)), and remains applicable to this final determination. That finding is posted at *www.regulations.gov* and is also available for public inspection between the hours of 8 a.m. and 5 p.m. weekdays in the Regulations Division, Office of General Counsel, Department of Housing and Urban Development, 451 7th Street SW, Room 10276, Washington, DC 20410–0500. Due to security measures at the HUD Headquarters building, please schedule an appointment to review the finding by calling the Regulations Division at 202–402–3055 (this is not a toll-free number). HUD welcomes and is prepared to receive calls from individuals who are deaf or hard of hearing, as well as individuals with speech or communication disabilities. To learn more about how to make an accessible telephone call, please visit *https://www.fcc.gov/consumers/guides/telecommunications-relay-service-trs*.

Damon Smith,

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Xochitl Torres Small,

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