## DEPARTMENT OF ENERGY

### 10 CFR Part 460

**[EERE–2009–BT–BC–0021]**

**RIN 1904–AC11**

## Energy Conservation Program: Energy Conservation Standards for Manufactured Housing

**AGENCY:** Office of Energy Efficiency and Renewable Energy, Department of Energy.

**ACTION:** Notice of supplemental notice of proposed rulemaking and request for comment.

**SUMMARY:** The U.S. Department of Energy (''DOE'' or ''the Department'') is publishing a supplemental notice of proposed rulemaking (''SNOPR'') to establish energy conservation standards for manufactured housing pursuant to the Energy Independence and Security Act of 2007. This document presents an updated proposal based on the 2021 version of the International Energy Conservation Code (''IECC'') and comments received during interagency consultation with the U.S. Department of Housing and Urban Development, as well as from stakeholders. This proposal presents two potential approaches—one would provide a set of ''tiered'' standards based on the manufacturer's retail list price for the manufactured home that would apply the 2021 IECC-based standards to manufactured homes, except that manufactured homes with a manufacturer's retail list price of $55,000 and below would be subject to less stringent building thermal envelope requirements based on manufacturer's retail list price. The alternative approach would apply standards based on the 2021 IECC to all manufactured homes, with no exceptions for building thermal envelope requirements based on manufacturer's retail list price.

**DATES:**

*Meeting:* DOE will hold a public meeting via webinar on Tuesday, September 28, 2021, from 11:00 a.m. to 4:00 p.m. See section VI, ''Public Participation,'' for webinar registration information, participant instructions and information about the capabilities available to webinar participants.

*Comments:* DOE will accept comments, data, and information regarding this SNOPR not later than October 25, 2021.

**ADDRESSES:** Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *https://www.regulations.gov.* Follow the instructions for submitting comments. Alternatively, interested persons may submit comments by email to: *Manufactured_Housing@ee.doe.gov.* Include docket number EERE–2009–BT–STD–0021 and/or RIN number 1904–AC11 in the subject line of the message. Submit electronic comments in WordPerfect, Microsoft Word, PDF, or ASCII file format, and avoid the use of special characters or any form of encryption.

Although DOE has routinely accepted public comment submissions through a variety of mechanisms, including postal mail and hand delivery/courier, the Department has found it necessary to make temporary modifications to the comment submission process in light of the ongoing Covid–19 pandemic. DOE is currently suspending receipt of public comments via postal mail and hand delivery/courier. If a commenter finds that this change poses an undue hardship, please contact Appliance Standards Program staff at (202) 586–1445 to discuss the need for alternative arrangements. Once the Covid–19 pandemic health emergency is resolved, DOE anticipates resuming all of its regular options for public comment submission, including postal mail and hand delivery/courier.

No telefacsimilies (faxes) will be accepted. For detailed instructions on submitting comments and additional information on the rulemaking process, see section VI of this document.

*Docket:* The docket for this activity, which includes **Federal Register** notices, comments, and other supporting documents/materials, is available for review at *https://www.regulations.gov.* All documents in the docket are listed in the *https://www.regulations.gov* index. However, not all documents listed in the index may be publicly available, such as information that is exempt from public disclosure.

The docket web page can be found at *https://www.regulations.gov/docket?D=EERE-2009-BT-BC-0021.* The docket web page contains instructions on how to access all documents, including public comments, in the docket. See section VI for information on how to submit comments through *https://www.regulations.gov.*

**FOR FURTHER INFORMATION CONTACT:**

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Mr. Matthew Ring, U.S. Department of Energy, Office of the General Counsel (GC–33), 1000 Independence Avenue SW, Washington, DC 20585; 202–586–2555; *matthew.ring@hq.doe.gov.*

**SUPPLEMENTARY INFORMATION:**

This SNOPR proposes to incorporate by reference into 10 CFR part 460 the following industry standards:

ANSI/ACCA 2 Manual J–2016 (''ACCA Manual J''), ''Manual J—Residential Load Calculation (8th edition)'', Copyright 2016.

ANSI/ACCA 3 Manual S–2014 (''ACCA Manual S''), ''Manual S—Residential Equipment Selection (2nd edition)'', Copyright 2014.

Copies of Manual J and Manual S may be purchased from Air Conditioning Contractors of America Inc., (ACCA), 2800 S Shirlington Road, Suite 300, Arlington, VA 22206, Telephone: 703–575–4477. *www.acca.org/*.

PNL–8006 (''Overall *U*-values and Heating/Cooling Loads—Manufactured Homes''), ''Overall *U*-values and Heating/Cooling Loads—Manufactured Homes'', C.C. Conner and Z.T. Taylor of Pacific Northwest Laboratory, prepared for the Department of Housing and Urban Development, published February 1992.

A copy of Overall *U*-Values and Heating/Cooling Loads—Manufactured Homes may be purchased from: *www.huduser.org/portal/publications/manufhsg/uvalue.html.* Telephone: 800–245–2691.

See section V.M of this document for further discussion of these standards.

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## I. Summary of the SNOPR

The Energy Independence and Security Act of 2007 (''EISA,'' Pub. L. 110–140) directs the U.S. Department of Energy (''DOE'' or in context, ''the Department'') to establish energy conservation standards for manufactured housing.[1] (42 U.S.C. 17071) Manufactured homes are constructed according to a code administered by the U.S. Department of Housing and Urban Development (''HUD Code''). 24 CFR part 3280. See also generally 42 U.S.C. 5401–5426. Structures, such as site-built and modular homes that are constructed to the state, local or regional building codes are excluded from the coverage of the HUD Code.[2]

EISA directs DOE to base the standards on the most recent version of the International Energy Conservation Code (''IECC'') and any supplements to that document, except in cases where DOE finds that the IECC is not cost-effective or where a more stringent standard would be more cost-effective, based on the impact of the IECC on the purchase price of manufactured housing and on total lifecycle construction and operating costs. (See 42 U.S.C. 17071(b)(1)) Standards shall be established after notice and an opportunity to comment by manufacturers of manufactured housing and other interested parties, and consultation with the Secretary of Housing and Urban Development (''HUD''), who may seek further counsel from the Manufactured Housing Consensus Committee. (42 U.S.C. 17071(a)(2)) The energy conservation standards established by DOE may (1) take into consideration the design and factory construction techniques of manufactured homes, (2) be based on the climate zones established by HUD rather than the climate zones of the IECC, and (3) provide for alternative practices that result in net estimated energy consumption equal to or less than the specified standards. (42 U.S.C. 17071(b)(2))

On June 17, 2016, DOE published in the **Federal Register** a notice of proposed rulemaking (''NOPR''), including proposals recommended by the negotiated rulemaking working group for manufactured housing. 81 FR 39756 (June 2016 NOPR). DOE also issued a comprehensive technical support document. *See* Document ID EERE–2009–BT–BC–0021–0136.[3] The agency also issued for public review and comment a draft Environmental Assessment (''EA'') pursuant to the National Environmental Policy Act. In conjunction with the draft EA, DOE issued a request for information that would help it analyze potential impacts of the proposed standards on the indoor air quality of manufactured homes. *See* Draft Environmental Assessment for Notice of Proposed Rulemaking, ''Energy Conservation Standards for Manufactured Housing'' With Request for Information on Impacts to Indoor Air Quality, 81 FR 42576 (June 30, 2016) (''2016 EA–RFI''). DOE received nearly 50 comments on the proposed rule during the comment period. In addition, DOE also received over 700 substantively similar form letters from individuals. DOE also received 7 comments to the 2016 EA–RFI during its comment period.

During DOE's interagency consultation with HUD, HUD expressed concerns about the adverse impacts on manufactured housing affordability that would likely follow if DOE were to adopt the approach laid out in its June 2016 NOPR. A variety of commenters also expressed concerns over the potentially negative impacts on the affordability of manufactured housing flowing from increased consumer costs resulting from DOE's approach in the June 2016 NOPR. DOE published a Notice of Data Availability (NODA) on August 3, 2018. 83 FR 38073 (August 2018 NODA). In the August 2018 NODA, DOE stated it was examining a number of possible alternatives to those proposed in the June 2016 NOPR on which it sought further input from the public, including the first-time costs related to the purchase of these homes.

After evaluating the comments received in response to the June 2016 NOPR and the August 2018 NODA, in this SNOPR, DOE proposes energy conservation standards for manufactured homes based on the 2021 IECC. These standards would be based on the current HUD zones.

In this SNOPR, DOE's primary proposal is the ''tiered'' approach, based on the 2021 IECC, wherein a subset of

[1] The National Manufactured Housing Construction and Safety Standards Act of 1974, as amended, defines ''manufactured home'' as ''a structure, transportable in one or more sections, which in the traveling mode is 8 body feet or more in width or 40 body feet or more in length or which when erected on-site is 320 or more square feet, and which is built on a permanent chassis and designed to be used as a dwelling with or without a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air-conditioning, and electrical systems contained therein; except that such term shall include any structure that meets all the requirements of this paragraph except the size requirements and with respect to which the manufacturer voluntarily files a certification required by the Secretary [pursuant to 24 CFR 3282.13] and complies with the standards established under this title [24 CFR part 3280]; and except that such term shall not include any self-propelled recreational vehicle.'' 42 U.S.C. 5402(6).

[2] See 42 U.S.C. 5403(f). See also 24 CFR 3282.12.

[3] Available at: *https://www.regulations.gov/document?D=EERE-2009-BT-BC-0021-0136.*

the energy conservation standards would be less stringent for certain manufactured homes in light of the cost-effectiveness considerations required by statute. DOE's alternate proposal is the ''untiered'' approach, wherein energy conservation standards for all manufactured homes would be based only on the 2021 IECC. Both proposals replace DOE's June 2016 proposal and the selected approach would be codified in a new part of the Code of Federal Regulations (''CFR'') under 10 CFR part 460 subparts A, B, and C.

As proposed in this document, subpart A presents generally the scope of the rule and provides definitions of key terms. Proposed subpart B would establish new requirements for manufactured homes that relate to climate zones, the building thermal envelope, air sealing, and installation of insulation. Subpart C proposes new requirements related to duct sealing, heating, ventilation, and air conditioning (''HVAC''); service hot water systems; mechanical ventilation fan efficacy; and heating and cooling equipment sizing.

Under either approach, subparts A and C would remain the same; however, the stringency of the requirements under proposed subpart B would depend on the manufacturer's retail list price of the manufactured home for the tiered approach. Under the tiered proposal, two sets of standards would be established in proposed subpart B (*i.e.,* Tier 1 and Tier 2). Tier 1 would apply to manufactured homes with a manufacturer's retail list price of $55,000 or less, and also incorporate building thermal envelope measures based on certain thermal envelope components subject to the 2021 IECC but would limit the incremental purchase price increase to an average of approximately $750. Tier 2 would apply to manufactured homes with a manufacturer's retail list price above $55,000, and incorporate building thermal envelope measures based on certain thermal envelope components and specifications of the 2021 IECC (*i.e.,* the Tier 2 requirements would be the same as those under the proposed single, ''untiered'' set of standards).

As mentioned previously, in the tiered proposal, DOE proposes to base the applicability of the two tiers on the manufacturer's retail list price. This is more appropriate than basing the tiers on the purchase price as the purchase price may not be known until after a manufactured home leaves the manufacturer, and manufacturers may have limited control of the final purchase price of manufactured homes sold by third-party retailers. DOE also notes that the manufacturer's retail list price is specified in EISA for the purpose of determining penalties for non-compliance. (42 U.S.C. 17071(d)) However, DOE relies on purchase price in its analysis for assessing incremental price increases for manufactured homes as an appropriate approximation for manufacturer's retail list price because available data for manufactured homes are only in terms of purchase price.

Under both approaches, DOE proposes to adopt a compliance date such that the standards would apply to manufactured homes starting one year after the publication date of the final rule in the **Federal Register**. While DOE has tentatively concluded that either approach could be considered cost-effective, DOE requests comment regarding the cost-effectiveness of both options to inform its final decision.

*A. Benefits and Costs to Purchasers of Manufactured Housing*

As explained in greater detail in section IV.A of this document and in chapter 9 of the SNOPR technical support document (''TSD''), DOE tentatively estimates that benefits to manufactured home homeowners—in terms of lifecycle cost (''LCC'') savings and energy cost savings of the requirements as proposed in both proposals—could outweigh the potential increase in purchase price for manufactured homes.

Table I.1 and Table I.2 present the average purchase price increase of a manufactured home as a result of the energy conservation standards for the tiered standards, *i.e.,* Tier 1 standard and Tier 2 standard, respectively. Table I.3 presents the average purchase price increase of a manufactured home as a result of the energy conservation standards for manufactured homes under the proposed single set of standards based on 2021 IECC (''untiered'' standard). The average purchase price increase for the Tier 2 standard and the untiered standard are the same.

TABLE I.1—NATIONAL AVERAGE MANUFACTURED HOUSING PURCHASE PRICE (AND PERCENTAGE) INCREASES UNDER TIER 1 STANDARD

[2020$]

| | Single-section | | Multi-section | |
|---|---|---|---|---|
| | $ | % | $ | % |
| Climate Zone 1 | $629 | 1.2 | $900 | 0.9 |
| Climate Zone 2 | 629 | 1.2 | 900 | 0.9 |
| Climate Zone 3 | 721 | 1.4 | 702 | 0.7 |
| National Average | 663 | 1.2 | 839 | 0.8 |

TABLE I.2—NATIONAL AVERAGE MANUFACTURED HOUSING PURCHASE PRICE (AND PERCENTAGE) INCREASES UNDER TIER 2 STANDARD

[2020$]

| | Single-section | | Multi-section | |
|---|---|---|---|---|
| | $ | % | $ | % |
| Climate Zone 1 | $2,574 | 4.8 | $4,143 | 4.0 |
| Climate Zone 2 | 4,820 | 9.1 | 6,167 | 5.9 |
| Climate Zone 3 | 4,659 | 8.8 | 5,839 | 5.6 |
| National Average | 3,914 | 7.4 | 5,289 | 5.1 |

TABLE I.3—NATIONAL AVERAGE MANUFACTURED HOUSING PURCHASE PRICE (AND PERCENTAGE) INCREASES UNDER THE UNTIERED STANDARD

[2020$]

| | Single-section | | Multi-section | |
|---|---|---|---|---|
| | $ | % | $ | % |
| Climate Zone 1 | $2,574 | 4.8 | $4,143 | 4.0 |
| Climate Zone 2 | 4,820 | 9.1 | 6,167 | 5.9 |
| Climate Zone 3 | 4,659 | 8.8 | 5,839 | 5.6 |
| National Average | 3,914 | 7.4 | 5,289 | 5.1 |

The analysis results for the annual energy cost savings and simple payback periods are projected to be the same for both the Tier 2 standard and the untiered standard because they have the same energy efficiency measures and inputs (*e.g.,* purchase price inputs). Because the loan parameters are different for both proposed standards, however, the lifecycle cost savings results are different. See section IV.A.2 for further details.

Table I.4 presents the estimated national average LCC savings and energy savings for the compliance year that a manufactured homeowner would experience under the proposals compared to a manufactured home constructed in accordance with the minimum requirements of existing HUD Manufactured Home Construction and Safety Standards (''HUD Code'') at 24 CFR part 3280 *et. seq.* Table I.4, Figure I.1, Figure I.2 and Figure I.3 present the nationwide average simple payback period (purchase price increase divided by first year energy cost savings) estimated under the proposals. The methods and information used for these analyses are discussed more in section IV.A.

TABLE I.4—NATIONAL AVERAGE PER-HOME COST SAVINGS UNDER THE SNOPR *

| | Single-section | Multi-section |
|---|---|---|
| **Tier 1 Standards** | | |
| Lifecycle Cost Savings (30-Year Lifetime) | $1,643 | $2,235 |
| Lifecycle Cost Savings (10-Year Lifetime) | $761 | $1,050 |
| Annual Energy Cost Savings in 2020$ | $181 | $242 |
| Simple Payback Period | 3.7 | 3.5 |
| **Tier 2 Standards** | | |
| Lifecycle Cost Savings (30-Year Lifetime) | $2,105 | $3,033 |
| Lifecycle Cost Savings (10-Year Lifetime) | $124 | $264 |
| Annual Energy Cost Savings in 2020$ | $359 | $499 |
| Simple Payback Period | 10.9 | 10.6 |
| **Untiered Standard** | | |
| Lifecycle Cost Savings (30-Year Lifetime) | $1,727 | $2,511 |
| Lifecycle Cost Savings (10-Year Lifetime) | ($12) | $77 |
| Annual Energy Cost Savings in 2020$ | $359 | $499 |
| Simple Payback Period | 10.9 | 10.6 |

* Negative values in parenthesis.

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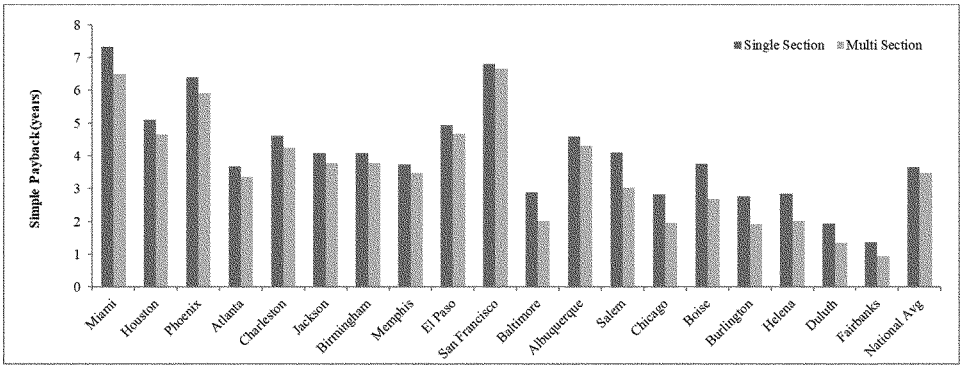


**Figure I.1: Simple Payback Period of the Tier 1 Standard**

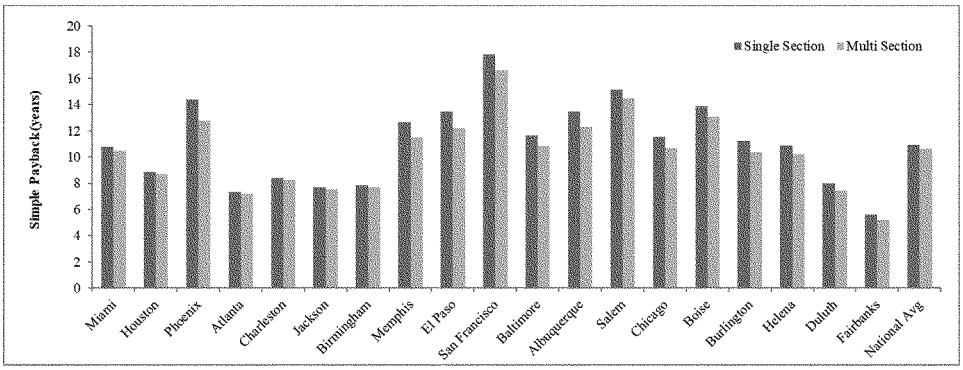


**Figure I.2: Simple Payback Period of the Tier 2 Standard**

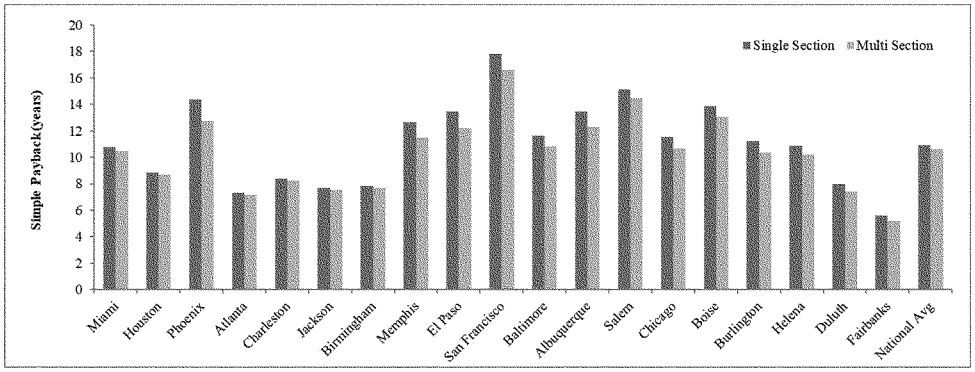


**Figure I.3: Simple Payback Period of the Untiered Standard**

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*B. Impact on Manufacturers*

As discussed in more detail in section IV.B of this document and chapter 12 of the SNOPR TSD, the industry net present value (''INPV'') is the sum of the discounted cash flows to the industry from the reference year (2021) through the end of the analysis period (2052). Using a real discount rate of 9.2 percent, DOE tentatively estimates the INPV under a no-regulatory-action alternative, which would maintain energy conservation requirements at the levels established in the existing HUD Code, to be $16.2 billion. Under the tiered approach, the change in INPV would range from −1.7 percent to 2.0 percent. Industry would incur total conversion costs of $1.8 million. Under the untiered standard, the change in INPV would range from −2.1 percent to 2.4 percent. Industry would incur total conversion costs of $1.8 million.

*C. Nationwide Impacts*

As described in more detail in section IV.C of this document and chapter 11 of the SNOPR TSD, DOE's national impact analysis (''NIA'') projects a net benefit to the nation as a whole under both the tiered and untiered proposals, in terms of national energy savings (''NES'') and the net present value (''NPV'') of expected total manufactured homeowner costs and savings compared with the baseline. In this case, the baseline is manufactured homes built to the minimum standards established in the HUD Code. As part of its NIA, DOE has projected the energy savings, operating cost savings, incremental costs, and NPV of manufactured homeowner benefits for manufactured homes sold in a 30-year period from the compliance year of 2023 through 2052. The NIA builds off the LCC analysis by aggregating results for all affected shipments over a 30-year period. All NES and percentage energy savings calculations are relative to a no-regulatory-action alternative, which would maintain energy conservation requirements at the levels established in the existing HUD Code.

Table I.5 illustrates the cumulative NES over the 30-year analysis period under both the tiered and untiered standards on a full-fuel-cycle (''FFC'') energy savings basis. FFC energy savings apply a factor to account for losses associated with generation, transmission, and distribution of electricity, and the energy consumed in extracting, processing, and transporting or distributing primary fuels. NES differ among the different climate zones because of varying energy conservation requirements and varying shipment projections in each climate zone. All NES and percentage energy savings calculations are relative to a no-regulatory-action alternative, which as discussed would maintain energy conservation requirements at the levels established in the existing HUD Code. DOE tentatively estimates that, under the tiered standards, 2.32 quads of FFC energy would be saved relative to the baseline over the 30-year analysis period. DOE tentatively estimates that, under the proposed untiered standard, 2.58 quads of FFC energy would be saved relative to the baseline over the 30-year analysis period.

TABLE I.5—CUMULATIVE FULL-FUEL-CYCLE NATIONAL ENERGY SAVINGS OF MANUFACTURED HOMES PURCHASED 2023–2052 WITH A 30-YEAR LIFETIME

| | Single-section quadrillion Btu (quads) | Multi-section (quads) |
|---|---|---|
| **Tiered Standards** | | |
| Climate Zone 1 | 0.222 | 0.616 |
| Climate Zone 2 | 0.172 | 0.491 |
| Climate Zone 3 | 0.324 | 0.499 |
| Total | 0.718 | 1.606 |
| **Untiered Standard** | | |
| Climate Zone 1 | 0.316 | 0.616 |
| Climate Zone 2 | 0.254 | 0.491 |
| Climate Zone 3 | 0.405 | 0.499 |
| Total | 0.976 | 1.606 |

Table I.6 and Table I.7 illustrate the NPV of consumer benefits over the 30-year analysis period under both proposals for a discount rate of 7 percent and 3 percent, respectively. The NPV of consumer benefits differ among the three climate zones because of differing initial costs and corresponding operating cost savings, as well as differing shipment projections in each climate zone.

TABLE I.6—NET PRESENT VALUE OF CONSUMER BENEFITS FOR MANUFACTURED HOMES PURCHASED 2023–2052 WITH A 30-YEAR LIFETIME AT A 7% DISCOUNT RATE

| | Single-section (billion 2020$) | Multi-section (billion 2020$) |
|---|---|---|
| **Tiered Standards** | | |
| Climate Zone 1 | $0.22 | $0.47 |
| Climate Zone 2 | 0.08 | 0.08 |
| Climate Zone 3 | 0.42 | 0.36 |
| Total | 0.72 | 0.90 |
| **Untiered Standard** | | |
| Climate Zone 1 | 0.24 | 0.46 |
| Climate Zone 2 | 0.00 | 0.06 |
| Climate Zone 3 | 0.26 | 0.35 |
| Total | 0.49 | 0.87 |

TABLE I.7—NET PRESENT VALUE OF CONSUMER BENEFITS FOR MANUFACTURED HOMES PURCHASED 2023–2052 WITH A 30-YEAR LIFETIME AT A 3% DISCOUNT RATE

| | Single-section (billion 2020$) | Multi-section (billion 2020$) |
|---|---|---|
| **Tiered Standards** | | |
| Climate Zone 1 | $0.70 | $1.69 |
| Climate Zone 2 | 0.38 | 0.79 |
| Climate Zone 3 | 1.34 | 1.50 |
| Total | 2.42 | 3.98 |
| **Untiered Standard** | | |
| Climate Zone 1 | 0.85 | 1.63 |
| Climate Zone 2 | 0.29 | 0.73 |
| Climate Zone 3 | 1.12 | 1.44 |
| Total | 2.26 | 3.80 |

*D. Nationwide Energy Savings and Emissions Benefits*

As discussed in section IV.C of this document and in the NIA included in chapter 11 of the SNOPR TSD, DOE's analyses indicate that both the tiered and untiered proposals would reduce overall demand for energy in manufactured homes. Both proposals also would produce environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases associated with electricity production.

Emissions avoided under the proposed rule as a result of the energy savings that would be achieved within manufactured homes. As discussed previously, DOE tentatively estimates that, under the proposed tiered standard, 2.32 quads of FFC energy would be saved over the 30-year analysis period relative to the baseline. DOE tentatively estimates that, under the untiered standards, 2.58 quads of FFC energy would be saved over the 30-year analysis period relative to the baseline. DOE estimates reductions in emissions of six pollutants associated with energy savings: Carbon dioxide ($CO_2$), mercury (Hg), nitric oxide and nitrogen dioxide ($NO_X$), sulfur dioxide ($SO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$). These emissions reductions are referred to as ''site'' emissions reductions. Furthermore, DOE estimates reductions in emissions associated with the production of these fuels (including extracting, processing, and transporting these fuels to power plants or manufactured homes). These emissions reductions are referred to as ''upstream'' emissions reductions. Together, site emissions reductions and upstream emissions reductions account for the FFC.

Table I.8 lists the emissions reductions under the proposed rule for both single-section and multi-section manufactured homes.

TABLE I.8—EMISSIONS REDUCTIONS ASSOCIATED WITH ELECTRICITY PRODUCTION FOR MANUFACTURED HOMES PURCHASED 2023–2052 WITH A 30-YEAR LIFETIME

| Pollutant | Tiered standard | | Untiered standards | |
|---|---|---|---|---|
| | Single-section | Multi-section | Single-section | Multi-section |
| **Site Emissions Reductions** | | | | |
| $CO_2$ (million metric tons) | 31.7 | 67.7 | 42.4 | 67.7 |
| Hg (metric tons) | 0.063 | 0.146 | 0.087 | 0.146 |
| $NO_X$ (thousand metric tons) | 18.3 | 37.3 | 24 | 37.3 |
| $SO_2$ (thousand metric tons) | 12.8 | 27.7 | 17.2 | 27.7 |
| $CH_4$ (thousand metric tons) | 1.86 | 4.14 | 2.51 | 4.14 |
| $N_2O$ (thousand metric tons) | 0.35 | 0.74 | 0.47 | 0.74 |
| **Upstream Emissions Reductions** | | | | |
| $CO_2$ (million metric tons) | 3.1 | 6.32 | 4.09 | 6.32 |
| Hg (metric tons) | 3.42E–4 | 7.67E–04 | 4.65E–04 | 7.67E–04 |
| $NO_X$ (thousand metric tons) | 39.7 | 81.7 | 52.5 | 81.7 |
| $SO_2$ (thousand metric tons) | 0.32 | 0.64 | 0.42 | 0.64 |
| $CH_4$ (thousand metric tons) | 221 | 463 | 293 | 463 |
| $N_2O$ (thousand metric tons) | 0.016 | 0.033 | 0.021 | 0.033 |
| **Total Emissions Reductions** | | | | |
| $CO_2$ (million metric tons) | 34.8 | 74.0 | 46.4 | 74 |
| Hg (metric tons) | 0.064 | 0.147 | 0.087 | 0.147 |
| $NO_X$ (thousand metric tons) | 58 | 119 | 76.5 | 119 |
| $SO_2$ (thousand metric tons) | 13.1 | 28.3 | 17.6 | 28.3 |
| $CH_4$ (thousand metric tons) | 223 | 467 | 296 | 467 |
| $N_2O$ (thousand metric tons) | 0.37 | 0.78 | 0.49 | 0.78 |

DOE calculates the value of the $CO_2$, $CH_4$, and $N_2O$ (collectively, greenhouse gases or GHGs) using a range of values per metric ton of pollutant, consistent with the interim estimates issued in February 2021 under Executive Order 13990. The derivation of these Social Cost of Carbon, Methane, and Nitrous Oxide values is discussed in section IV.D of this document. DOE also estimated the monetary benefits of $NO_X$ and $SO_2$ emission reduction, also discussed in section IV.D of this document.

Table I.9 provides the NPV of monetized emissions benefits from reduction in emissions of GHGs for which social cost is considered, and $NO_X$ and $SO_2$ under both proposals.

TABLE I.9—NET PRESENT VALUE OF MONETIZED BENEFITS FROM GHG AND EMISSIONS REDUCTIONS UNDER THE SNOPR

| Monetary benefits | Discount rate (%) | Net present value (million 2020$) | | | |
|---|---|---|---|---|---|
| | | Tiered standard | | Untiered standards | |
| | | Single-section | Multi-section | Single-section | Multi-section |
| GHG Reduction (using avg. social costs at 5% discount rate) * | 5 | 344.4 | 731.0 | 459.5 | 731.0 |
| GHG Reduction (using avg. social costs at 3% discount rate) * | 3 | 1,448.6 | 3,076.4 | 1,932.9 | 3,076.4 |
| GHG Reduction (using avg. social costs at 2.5% discount rate) * | 2.5 | 2,372.9 | 5,039.4 | 3,166.2 | 5,039.4 |

TABLE I.9—NET PRESENT VALUE OF MONETIZED BENEFITS FROM GHG AND EMISSIONS REDUCTIONS UNDER THE SNOPR—Continued

| Monetary benefits | Discount rate (%) | Net present value (million 2020$) | | | |
|---|---|---|---|---|---|
| | | Tiered standard | | Untiered standards | |
| | | Single-section | Multi-section | Single-section | Multi-section |
| GHG Reduction (using 95th percentile social costs at 3% discount rate) * ..... | 3 | 4,347.5 | 9,235.5 | 5,801.6 | 9,235.5 |
| $NO_X$ Reduction ** ..... | 3 | 149.0 | 297.1 | 194.6 | 297.1 |
| | 7 | 52.4 | 104.8 | 68.6 | 104.8 |
| $SO_2$ Reduction ** ..... | 3 | 240.9 | 493.8 | 317.2 | 493.8 |
| | 7 | 84.8 | 174.5 | 111.8 | 174.5 |

* Estimates of SC-$CO_2$ SC-$CH_4$, and SC-$N_2O$ are calculated using a range of discount rates for use in regulatory analyses. Three sets of values are based on the average social costs from the integrated assessment models, at discount rates of 5 percent, 3 percent, and 2.5 percent. The fourth set, which represents the 95th percentile of the social cost distributions calculated using a 3-percent discount rate, is included to represent higher-than-expected impacts from climate change further out in the tails of the social cost distributions. The social cost values are emission year specific. See section IV.D for more details.

** The benefits from $NO_x$ and $SO_2$ were based on the low estimate monetized value. See section IV.D.2 of this document for more details.

*E. Total Benefits and Costs*

Table I.10 summarizes the economic benefits and costs expected to result from the proposed standards for manufactured homes.

TABLE I.10—SUMMARY OF ECONOMIC BENEFITS AND COSTS TO MANUFACTURED HOME HOMEOWNERS UNDER THE PROPOSED STANDARDS

| | Net present value (billion 2020$) | | Discount rate (%) |
|---|---|---|---|
| | Tiered | Untiered | |
| Benefits: | | | |
| Consumer Operating Cost Savings ..... | 5.5 ..... | 6.1 ..... | 7. |
| | 14.3 ..... | 15.9 ..... | 3. |
| GHG Reduction (using avg. social costs at 5% discount rate) * ..... | 1.1 ..... | 1.2 ..... | 5. |
| GHG Reduction (using avg. social costs at 3% discount rate) * ..... | 4.5 ..... | 5.0 ..... | 3. |
| GHG Reduction (using avg. social costs at 2.5% discount rate) * ..... | 7.4 ..... | 8.2 ..... | 2.5. |
| GHG Reduction (using 95th percentile social costs at 3% discount rate) * ..... | 13.6 ..... | 15.0 ..... | 3 |
| $NO_X$ Reduction ..... | 0.2 ..... | 0.2 ..... | 7. |
| | 0.4 ..... | 0.5 ..... | 3. |
| $SO_2$ Reduction ..... | 0.3 ..... | 0.3 ..... | 7. |
| | 0.7 ..... | 0.8 ..... | 3. |
| Total Benefits ..... | 7 to 19.5 ..... | 7.8 to 21.6 ..... | 7 plus GHG range. |
| | 10.5 ..... | 11.6 ..... | 7. |
| | 20.0 ..... | 22.2 ..... | 3. |
| | 16.6 to 29.1 ..... | 18.4 to 32.2 ..... | 3 plus GHG range. |
| Costs: | | | |
| Consumer Incremental Product Costs † ..... | 3.9 ..... | 4.7 ..... | 7. |
| | 7.9 ..... | 9.6 ..... | 3. |
| Total Net Benefits: | | | |
| Including GHG and Emissions Reduction Monetized Value ..... | 3.1 to 15.6 ..... | 3 to 16.9 ..... | 7 plus GHG range. |
| | 6.6 ..... | 6.9 ..... | 7. |
| | 12.1 ..... | 12.6 ..... | 3. |
| | 8.7 to 21.2 ..... | 8.7 to 22.6 ..... | 3 plus GHG range. |

**Note:** This table presents the costs and benefits associated with manufactured homes shipped in 2023–2052.

* The benefits from GHG reduction were calculated using global benefit-per-ton values. See section IV.D.2 of this document for more details.

** Total Benefits for both the 3-percent and 7-percent cases are presented using the average GHG social costs with 3-percent discount rate. In the rows labeled ''7% plus GHG range'' and ''3% plus GHG range,'' the consumer benefits and $NO_X$ and $SO_2$ benefits are calculated using the labeled discount rate, and those values are added to the GHG reduction using each of the four GHG social cost cases.

† The incremental costs include incremental costs associated with principal and interest, mortgage and property tax for the analyzed loan types.

The benefits and costs of the proposed standards for manufactured housing sold in 2023–2052 can also be expressed in terms of annualized values. The monetary values for the total annualized net benefits are (1) the savings in consumer operating costs, minus (2) the increases in product installed costs, plus (3) the value of the benefits of GHG and $NO_X$ and $SO_2$ emission reductions, all annualized.[4] Total Benefits for both the 3-percent and 7-percent cases are presented using the average social costs

[4] To convert the time-series of costs and benefits into annualized values, DOE calculated a present value in 2020, the year used for discounting the NPV of total consumer costs and savings. For the benefits, DOE calculated a present value associated with each year's shipments in the year in which the shipments occur (*e.g.,* 2020 or 2030), and then discounted the present value from each year to 2020. The calculation uses discount rates of 3 and 7 percent for all costs and benefits. Using the present value, DOE then calculated the fixed annual payment over a 30-year period, starting in the compliance year, which yields the same present value.

with 3-percent discount rate. Estimates of social cost of greenhouse gases (''SC–GHG'') values are presented for all four discount rates in section IV.D.4.b of this document.

The national operating cost savings are domestic private U.S. consumer monetary savings that occur as a result of purchasing the covered housing and are measured for the lifetime of manufactured housing shipped in 2023–2052. The benefits associated with reduced GHG emissions achieved as a result of the proposed standards are also calculated based on the lifetime of manufactured housing shipped in 2023–2052.

Table I.11 and Table I.12 present the total estimated benefits and costs to manufactured housing homeowners associated with the proposed tiered standard and the untiered standards, expressed in terms of annualized values.

TABLE I.11—ANNUALIZED BENEFITS AND COSTS TO MANUFACTURED HOME HOMEOWNERS UNDER THE PROPOSED TIERED STANDARD

| Category | Primary estimate | Low-net-benefits estimate | High-net-benefits estimate | Discount rate (%) |
|---|---|---|---|---|
| | (Million 2020$/year) | | | |
| Benefits: | | | | |
| Consumer Operating Cost Savings | 509 | 471 | 554 | 7. |
| | 774 | 701 | 858 | 3. |
| GHG Reduction (using avg. social costs at 5% discount rate) ** | 70 | 69 | 74 | 5. |
| GHG Reduction (using avg. social costs at 3% discount rate) ** | 231 | 227 | 243 | 3. |
| GHG Reduction (using avg. social costs at 2.5% discount rate) ** | 354 | 348 | 374 | 2.5. |
| GHG Reduction (using 95th percentile social costs at 3% discount rate) ** | 693 | 681 | 730 | 3. |
| $NO_X$ Reduction ** | 13 | 12 | 13 | 7. |
| | 23 | 22 | 24 | 3. |
| $SO_2$ Reduction ** | 21 | 21 | 22 | 7. |
| | 37 | 37 | 39 | 3. |
| Total Benefits †† | 613 to 1,236 | 573 to 1,185 | 663 to 1,319 | 7 plus GHG range. |
| | 773 | 731 | 832 | 7. |
| | 1,065 | 987 | 1,165 | 3. |
| | 904 to 1,527 | 829 to 1,441 | 995 to 1,651 | 3 plus GHG range. |
| Costs: | | | | |
| Consumer Incremental Product Costs † | 359 | 352 | 385 | 7. |
| | 427 | 407 | 464 | 3. |
| Total Net Benefits: | | | | |
| Including GHG and Emissions Reduction Monetized Value †† | 254 to 877 | 221 to 833 | 278 to 934 | 7 plus GHG range. |
| | 414 | 379 | 447 | 7. |
| | 638 | 580 | 701 | 3. |
| | 477 to 1,100 | 422 to 1,034 | 531 to 1,187 | 3 plus GHG range. |

**Note:** This table presents the annualized costs and benefits associated with manufactured homes shipped in 2023—2052. These results include benefits to consumers which accrue after 2052 from the products purchased in 2023—2052. The Primary, Low Net Benefits, and High Net Benefits Estimates utilize projections of energy prices from the *AEO2020* Reference case, Low Economic Growth case, and High Economic Growth case, respectively. In addition, incremental product costs reflect a medium decline rate in the Primary Estimate, a low decline rate in the Low Net Benefits Estimate, and a high decline rate in the High Net Benefits Estimate. The methods used to derive projected price trends are explained in section IV.A and IV.C of this document. Note that the Benefits and Costs may not sum to the Net Benefits due to rounding.

* The benefits from GHG reduction were calculated using global benefit-per-ton values. See section IV.D.2 of this document for more details.

** The benefits from $NO_X$ and $SO_2$ were based on the low estimate monetized value. See section IV.D.2 of this document for more details.

† The incremental costs include incremental costs associated with principal and interest, mortgage and property tax for the analyzed loan types. Further discussion can be found in chapter 8 of the TSD.

†† Total Benefits for both the 3-percent and 7-percent cases are presented using the average social costs with 3-percent discount rate. In the rows labeled ''7% plus GHG range'' and ''3% plus GHG range,'' the consumer cost and benefits and $NO_X$ and $SO_2$ benefits are calculated using the labeled discount rate, and those values are added to the GHG reduction calculation using each of the four social cost cases.

TABLE I.12—ANNUALIZED BENEFITS AND COSTS TO MANUFACTURED HOME HOMEOWNERS UNDER THE PROPOSED UNTIERED STANDARDS

| Category | Primary estimate | Low-net-benefits estimate | High-Net-benefits estimate | Discount rate (%) |
|---|---|---|---|---|
| | (Million 2020$/year) | | | |
| Benefits: | | | | |
| Consumer Operating Cost Savings | 565 | 523 | 615 | 7. |
| | 859 | 778 | 951 | 3. |
| GHG Reduction (using avg. social costs at 5% discount rate) ** | 77 | 76 | 81 | 5. |
| GHG Reduction (using avg. social costs at 3% discount rate) ** | 256 | 251 | 269 | 3. |
| GHG Reduction (using avg. social costs at 2.5% discount rate) ** | 392 | 385 | 414 | 2.5. |
| GHG Reduction (using 95th percentile social costs at 3% discount rate) ** | 767 | 754 | 808 | 3. |
| $NO_X$ Reduction ** | 14 | 14 | 15 | 7. |
| | 25 | 25 | 26 | 3. |
| $SO_2$ Reduction ** | 23 | 23 | 24 | 7. |
| | 41 | 41 | 43 | 3. |
| Total Benefits †† | 679 to 1,369 | 636 to 1,314 | 735 to 1,462 | 7 plus GHG range. |
| | 858 | 811 | 923 | 7. |
| | 1,181 | 1,095 | 1,290 | 3. |
| | 1,003 to 1,693 | 920 to 1,597 | 1,102 to 1,829 | 3 plus GHG range. |
| Costs: | | | | |
| Consumer Incremental Product Costs † | 440 | 429 | 471 | 7. |
| | 530 | 503 | 576 | 3. |

TABLE I.12—ANNUALIZED BENEFITS AND COSTS TO MANUFACTURED HOME HOMEOWNERS UNDER THE PROPOSED UNTIERED STANDARDS—Continued

| Category | Primary estimate | Low-net-benefits estimate | High-Net-benefits estimate | Discount rate (%) |
|---|---|---|---|---|
| | (Million 2020$/year) | | | |
| Total Net Benefits: | | | | |
| Including GHG and Emissions Reduction Monetized Value †† | 239 to 929 | 207 to 885 | 264 to 991 | 7 plus GHG range. |
| | 418 | 382 | 452 | 7. |
| | 651 | 592 | 714 | 3. |
| | 473 to 1,163 | 417 to 1,094 | 526 to 1,253 | 3 plus GHG range. |

**Note:** This table presents the annualized costs and benefits associated with manufactured homes shipped in 2023—2052. These results include benefits to consumers which accrue after 2052 from the products purchased in 2023—2052. The Primary, Low Net Benefits, and High Net Benefits Estimates utilize projections of energy prices from the *AEO2020* Reference case, Low Economic Growth case, and High Economic Growth case, respectively. In addition, incremental product costs reflect a medium decline rate in the Primary Estimate, a low decline rate in the Low Net Benefits Estimate, and a high decline rate in the High Net Benefits Estimate. The methods used to derive projected price trends are explained in section IV.A and IV.C of this document. Note that the Benefits and Costs may not sum to the Net Benefits due to rounding.

* The benefits from GHG reduction were calculated using global benefit-per-ton values. See section IV.D.2 of this document for more details.

** The benefits from $NO_X$ and $SO_2$ were based on the low estimate monetized value. See section IV.D.2 of this document for more details.

† The incremental costs include incremental costs associated with principal and interest, mortgage and property tax for the analyzed loan types. Further discussion can be found in chapter 8 of the TSD.

†† Total Benefits for both the 3-percent and 7-percent cases are presented using the average social costs with 3-percent discount rate. In the rows labeled ''7% plus GHG range'' and ''3% plus GHG range,'' the consumer cost and benefits and $NO_X$ and $SO_2$ benefits are calculated using the labeled discount rate, and those values are added to the GHG reduction calculation using each of the four social cost cases.

DOE's analysis of the national impacts of the proposed standards is described in sections IV.C, IV.D, and IV.E of this document.

*F. Conclusion*

DOE has tentatively determined that the energy conservation standards under either approach in this SNOPR (*i.e.,* the tiered approach or the untiered approach) could be considered cost-effective when evaluating the impact of the standards on the purchase price of a manufactured home and on the total lifecycle construction and operating costs, but DOE requests comment regarding the cost-effectiveness of both options to inform its final decision. Additionally, DOE has tentatively determined that under either proposal the benefits to the Nation of the standards (energy savings, consumer LCC savings, positive NPV of consumer benefit, and emission reductions) outweigh the burdens (loss of INPV, LCC increases for some homeowners of manufactured housing, and price-sensitive consumers who do not purchase manufactured homes).

## II. Introduction

This section addresses the legal and factual background to date regarding DOE's efforts to establish energy conservation standards for manufactured housing. By statute, DOE is obligated to set standards for manufactured housing in consultation with HUD and to consider certain specific factors when establishing these standards. DOE is also obligated to update these standards within a prescribed period of time.

*A. Authority*

Section 413 of EISA directs DOE to:

- Establish standards for energy conservation in manufactured housing;
- Provide notice of, and an opportunity for comment on, the proposed standards by manufacturers of manufactured housing and other interested parties;
- Consult with the Secretary of HUD, who may seek further counsel from the Manufactured Housing Consensus Committee (MHCC); and
- Base the energy conservation standards on the most recent version of the IECC and any supplements to that document, except in cases where DOE finds that the IECC is not cost-effective or where a more stringent standard would be more cost-effective, based on the impact of the IECC on the purchase price of manufactured housing and on total lifecycle construction and operating costs.

(42 U.S.C. 17071(a) and (b)(1))

Section 413 of EISA also provides that DOE may:

- Consider the design and factory construction techniques of manufactured housing;
- Base the climate zones on the climate zones established by HUD [5] rather than the climate zones under the IECC; and
- Provide for alternative practices that, while not meeting the specific standards established by DOE, result in net estimated energy consumption equal to or less than the specific energy conservation standards.

(42 U.S.C. 17071(b)(2))

DOE is directed to update its standards not later than one year after any revision to the IECC. (42 U.S.C. 17071(b)(3)) Finally, under EISA, a manufacturer of manufactured housing that violates a provision of Part 460 ''is liable to the United States for a civil penalty not exceeding 1 percent of the manufacturer's retail list price of the manufactured housing.'' (42 U.S.C. 17071(c))

*B. Background*

1. Current Standards

Section 413 of EISA provides DOE with the authority to regulate energy conservation in manufactured housing, an area of the building construction industry traditionally regulated by HUD. HUD has regulated the manufactured housing industry since 1976, when it first promulgated the HUD Code. (42 U.S.C. 5401 *et seq.;* 24 CFR part 3280) The purpose of the HUD Code includes protecting the quality, durability, safety, and affordability of manufactured homes; facilitating the availability of affordable manufactured homes and increasing homeownership for all Americans; protecting residents of manufactured homes with respect to personal injuries and the amount of insurance costs and property damages in manufactured housing; and ensuring that the public interest in, and need for, affordable manufactured housing is duly considered in all determinations relating to the Federal standards and their enforcement. (42 U.S.C. 5401(b))

The HUD Code includes requirements related to the energy conservation of

[5] The statute uses the term ''climate zones'' in reference to the HUD requirements (42 U.S.C. 17071(b)(2)(B). HUD has not established ''climate zones'' but has established ''insulation zones.'' See, *U/O Value Zone Map for Manufactured Housing* at 24 CFR 3280.506. DOE understands the statutory reference to ''climate zones'' in this context to mean the established insulation zones at 24 CFR 3280.506.

manufactured homes. Specifically, Subpart F of the HUD Code, entitled ''Thermal Protection,'' establishes requirements for $U_o$ of the building thermal envelope. $U_o$ is a measurement of the heat loss or gain rate through the building thermal envelope of a manufactured home; therefore, a lower $U_o$ corresponds with a more insulated building thermal envelope. The HUD Code contains maximum requirements for the combined $U_o$ value of walls, ceilings, floors, fenestration, and external ducts within the building thermal envelope for manufactured homes installed in different zones. 24 CFR 3280.506(a).

The HUD Code also provides an alternate pathway to compliance that allows manufacturers to construct manufactured homes that meet adjusted $U_o$ requirements based on the installation of high-efficiency heating and cooling equipment in the manufactured home. 24 CFR 3280.508(d). Moreover, Subpart F of the HUD Code establishes requirements to reduce air leakage through the building thermal envelope. 24 CFR 3280.505.

Subpart H of the HUD Code, entitled ''Heating, Cooling, and Fuel Burning Systems,'' establishes requirements for sealing air supply ducts and for insulating both air supply and return ducts. 24 CFR 3280.715(a). *R*-value is the measure of a building component's ability to resist heat flow (thermal resistance). A higher *R*-value represents a greater ability to resist heat flow and generally corresponds with a thicker level of insulation. The HUD Code contains no requirements for fenestration solar heat gain coefficient (''SHGC''), mechanical system piping insulation, or installation of insulation.

The statutory authority for DOE's rulemaking effort is different from the statutory authority underlying the HUD Code. EISA directs DOE to establish energy conservation standards for manufactured housing without reference to existing HUD Code requirements that also address energy conservation. However, EISA also requires DOE to consult with HUD. (42 U.S.C. 17071(a)(2)(B)) Such consultations have informed DOE in development of the regulations proposed in this document, and DOE remains cognizant of the HUD Code, as well as HUD's Congressional charge to protect the quality, durability, safety, affordability, and availability of manufactured homes. Compliance with the DOE requirements would not prevent a manufacturer from complying with the requirements set forth in the HUD Code. Section III.F provides a crosswalk of the energy conservation standards that are proposed in this rule with the standards in the HUD Code. Moreover, as discussed further in section III, DOE considered the potential impact on manufactured home purchasers resulting from costs associated with additional energy efficiency measures.

2. The International Energy Conservation Code (IECC)

The statutory authority for this rulemaking requires DOE to base its standards on the most recent version of the IECC and any supplements to that document, subject to certain exceptions and considerations. (42 U.S.C. 17071(b)(1)) The IECC is a nationally recognized model code, developed under the auspices of and published by the International Code Council (''ICC''). Many state and local governments have adopted the IECC [6] in establishing minimum design and construction requirements for the energy efficiency of residential and commercial buildings, including site-built residential and modular homes.[7] The IECC is developed through a consensus process that seeks input from a number of relevant stakeholders and is updated on a rolling basis, with new editions of the IECC published approximately every three years. The IECC was first published in 1998, with the most recent version, the 2021 IECC, being published in January 2021.

The 2021 IECC is divided into two major sections, with provisions for both residential and commercial buildings. The manufactured housing energy conservation standards and test procedure are based on the requirements for residential buildings. The residential building requirements of the 2021 IECC, however, are not specific to manufactured housing.

Chapter 4 of the residential section of the 2021 IECC sets forth specifications for residential energy efficiency, including specifications for building thermal envelope energy conservation, thermostats, duct insulation and sealing, mechanical system piping insulation, heated water circulation system, and mechanical ventilation. To the extent that the HUD Code regulates similar aspects of energy conservation as the 2021 IECC, the 2021 IECC is generally considered more stringent than the corresponding requirements in the HUD Code, given that many areas of the HUD Code have not been updated as frequently as the IECC.

DOE notes that the IECC is designed for building structures that have a permanent foundation. Manufactured housing structures, however, are not built on permanent foundations but are built on a steel chassis to enable them to be moved or towed when needed. As a result, because they present their own set of unique considerations that the IECC was not intended to address, some aspects of the IECC are unable, or highly impractical, to be applied to manufactured housing. Instead, as DOE proposed in its June 2016 NOPR and consistent with the considerations required by EISA, this supplemental proposal utilizes aspects of the IECC that are appropriate for manufactured housing as the basis for the standards proposed herein, thereby accounting for the unique physical characteristics of manufactured housing.

Additionally, the ''tiered'' proposal provides an approach to mitigate the potential adverse impacts of increased costs on manufactured housing affordability that may arise from increasing the stringency of energy efficiency requirements applied to manufactured homes. In its tiered proposal, by dividing the market into designated manufacturer retail list price-based segments and assigning efficiency levels as appropriate for each segment, DOE suggests a way to address the affordability concerns presented in this housing segment, and relatedly the cost-effectiveness considerations set forth in EISA, while also promoting that the statutory objective of improving manufactured housing energy efficiency.

3. Development of the Initial Proposal and Responses

Manufactured housing accounts for approximately six percent of all homes in the United States.[8] Because the purchase price of manufactured homes often is lower than similarly sized site-built homes, manufactured homes serve as affordable housing options, particularly for low-income families. However, many manufactured homes often have higher utility bills than comparably sized site-built and modular homes in part due to different energy conservation standards and variability

[6] The current status of the adoption of the IECC is provided at *https://www.energycodes.gov/status-state-energy-code-adoption.*

[7] Modular homes are generally excluded from the coverage of the National Manufactured Housing Construction and Safety Standards Act and constructed to the same state, local or regional building codes as site-built homes. See 42 U.S.C. 5403(f); 24 CFR 3282.12.

[8] U.S Census Bureau, American Housing Survey 2019—National Summary Tables. Available at *https://www.census.gov/programs-surveys/ahs/data.html.*

among building codes and industry practices.[9]

Establishing improved energy conservation requirements for manufactured homes results in the dual benefit of reducing manufactured home energy use and enabling owners of manufactured homes to experience lower utility expenses over the long-term. Improved energy conservation standards are also expected to provide nationwide benefits of reducing utility energy production levels that would in turn reduce greenhouse gas emissions and other air pollutants.

DOE published an advance notice of proposed rulemaking (''ANOPR'') to initiate the process of developing energy conservation standards for manufactured housing and to solicit information and data from industry and stakeholders.[10] *See* 75 FR 7556 (February 22, 2010). DOE also consulted with HUD in developing the requirements and in obtaining input and suggestions that would increase energy conservation in manufactured housing, while maintaining affordability. In addition to meeting with HUD on multiple occasions, DOE attended three MHCC meetings, where DOE gathered information from MHCC members. DOE also initiated discussions with members of the manufactured housing industry following the issuance of the ANOPR.[11] A summary of each meeting is available at the *regulations.gov* web page at *https://www.regulations.gov/docket?D=EERE-2009-BT-BC-0021.* The June 2016 NOPR provides more details on the comments received in response to the ANOPR. 81 FR 39755 (June 17, 2016).

On June 25, 2013, DOE published a request for information (''RFI'') seeking information on indoor air quality, financing and related incentives, model systems of enforcement, and other studies and research relevant to DOE's effort to establish energy conservation standards for manufactured housing. 78 FR 37995 (''June 2013 RFI''). The June 2016 NOPR provides more details on the comments received on the RFI. 81 FR 39765 (June 17, 2016).

After reviewing the comments received in response to the ANOPR, the June 2013 RFI, and other stakeholder input, DOE ultimately determined that development of proposed manufactured housing energy conservation standards would benefit from a negotiated rulemaking process. On June 13, 2014, DOE published a notice of intent to establish a negotiated rulemaking manufactured housing (''MH'') working group to discuss and, if possible, reach consensus on a proposed rule. 79 FR 33873. On July 16, 2014, the MH working group was established under the Appliance Standards and Rulemaking Federal Advisory Committee (''ASRAC'') in accordance with the Federal Advisory Committee Act and the Negotiated Rulemaking Act. 79 FR 41456; 5 U.S.C. 561–570, App. 2. The MH working group consisted of representatives of interested stakeholders with a directive to consult, as appropriate, with a range of external experts on technical issues in developing a term sheet with recommendations on the proposed rule. The MH working group consisted of 22 members, including one member from ASRAC, and one DOE representative. 79 FR 41456. The MH working group met in person during six sets of public meetings held in 2014 on August 4–5, August 21–22, September 9–10, September 22–23, October 1–2, and October 23–24. 79 FR 48097 (Aug. 15, 2014); 79 FR 59154 (Oct. 1, 2014).

On October 31, 2014, the MH working group reached consensus on energy conservation standards in manufactured housing and assembled its recommendations for DOE into a term sheet that was presented to ASRAC. Public docket EERE–2009–BT–BC–0021–0107 (''Term Sheet''). ASRAC approved the term sheet during an open meeting on December 1, 2014 and sent it to the Secretary of Energy to develop a proposed rule.

On February 11, 2015, DOE published an RFI requesting information that would aid in determining proposed solar heat gain coefficient (''SHGC'') requirements for certain climate zones. 80 FR 7550 (''February 2015 RFI''). Following preparation and submission of the term sheet by the MH working group, DOE also consulted further with HUD regarding DOE's proposed energy conservation standards. In addition to meeting with HUD, DOE prepared two presentations to discuss the proposed rule with MHCC members, which were designed to gather information on development of the proposed standards.[12]

On June 17, 2016, DOE published a NOPR for the manufactured housing energy conservation standards rulemaking. 81 FR 39755. (''June 2016 NOPR'') DOE posted the NOPR analysis as well as the complete NOPR TSD on its website.[13] In response to comments on the 2013 RFI DOE also published the 2016 EA–RFI to accompany the 2016 NOPR. The draft EA drew no conclusions regarding the potential impacts on the indoor air quality of manufactured homes as a result of implementing any final energy conservation standard for these structures. DOE held a public meeting on July 13, 2016, to present the June 2016 NOPR, which included the proposed prescriptive and performance requirements, in addition to the LCC, NIA, manufacturer impact analysis (''MIA''), and emissions analyses. In response to the June 2016 NOPR, DOE received comments from a variety of stakeholders.

TABLE II.2—JUNE 2016 NOPR WRITTEN COMMENTS

| Organization(s) | Reference in this SNOPR | Organization type |
|---|---|---|
| Advanced Energy | Advanced Energy | Manufacturer. |
| Air Conditioning Contractors of America | ACCA | Trade association. |
| American Chemistry Council | ACC FSSC | Trade association. |
| American Council for an Energy-Efficient Economy | ACEEE | Efficiency organization. |
| American Gas Association and American Public Gas Association | AGA and APGA | Trade association. |
| Arkansas Manufactured Housing Association | AMHA | Trade association. |
| Better Homes AHEAD | Better Homes | Manufacturer. |

[9] American Council for an Energy-Efficient Economy; Mobilizing Energy Efficiency in the Manufactured Housing Sector, July 2012; *https://www.aceee.org/sites/default/files/publications/researchreports/a124.pdf.*

[10] The ANOPR comments can be accessed at: *https://www.regulations.gov/#!docketDetail;D=EERE-2009-BT-BC-0021.*

[11] These included discussions with the Manufactured Housing Institute (''MHI'') and several of its member manufacturers, the California Department of Housing and Community Development, the Georgia Manufactured Housing Division, three private-sector third-party primary inspection agencies under the HUD manufactured housing program, and one private-sector stakeholder familiar with manufactured housing.

[12] Available at *https://www.regulations.gov/document?D=EERE-2009-BT-BC-0021-0069* and *https://www.regulations.gov/document?D=EERE-2009-BT-BC-0021-0058.*

[13] The NOPR analysis, NOPR TSD, and NOPR public meeting information are available at *https://regulations.gov* under docket number EERE–2009–BT–BC–0021.

TABLE II.2—JUNE 2016 NOPR WRITTEN COMMENTS—Continued

| Organization(s) | Reference in this SNOPR | Organization type |
|---|---|---|
| Cato Institute | Cato Institute | |
| Cavco Industries | Cavco | Manufacturer. |
| Clayton Home Building Group | Clayton Homes | Manufacturer. |
| Commodore Corporation | Commodore Corporation | Manufacturer. |
| Community Owners (7 Part) Business Alliance | COBA | Trade association. |
| Earthjustice | Earthjustice | Efficiency organization. |
| Environmental Defense Fund, Institute for Policy Integrity, Natural resources Defense Council, and Union of Concerned Scientists. | Joint Advocates | Efficiency organizations. |
| George Washington University Regulatory Studies Center | GWU | Academia. |
| International Code Council | ICC | Codes organization. |
| Lippert Components | Lippert Components | Manufacturer. |
| Manufactured Housing Association for Regulatory Reform | MHARR | Trade association. |
| Manufactured Housing Consensus Committee | MHCC | Advisory committee. |
| Manufactured Housing Industry of Arizona | MHIAZ | Trade association. |
| Manufactured Housing Institute | MHI | Trade association. |
| Manufactured Housing Institute of Maryland | MHIM | Trade association. |
| Manufactured Housing Institute of South Carolina | MHISC | Trade Association. |
| Mississippi Manufactured Housing Association | MMHA | Trade association. |
| Modular Lifestyles, Inc. | Modular Lifestyles | Manufacturer. |
| National Propane Gas Association | NPGA | Trade association. |
| New Mexico Manufactured Housing Association | NMMHA | Trade association. |
| Next Step Network, Inc. | Next Step | Efficiency organization. |
| North Carolina Justice Center | NCJC | Consumer organization. |
| Northwest Energy Efficiency Alliance | NEEA | Efficiency organization. |
| Ohio Manufactured Homes Association | OMHA | Trade Association. |
| Palm Harbor Homes, Inc. | Palm Harbor Homes | Manufacturer. |
| Pennsylvania Manufactured Housing Association | PMHA | Trade association. |
| Bob Pfeiffer | Pfeiffer | Individual. |
| Pleasant Valley Homes, Inc. | Pleasant Valley Homes | Manufacturer. |
| Responsible Energy Codes Alliance | RECA | Efficiency organization. |
| Skyline Corporation | Skyline Corporation | Manufacturer. |
| South Mountain Co., Inc. | South Mountain | Manufacturer. |
| Systems Building Research Alliance | SBRA | Trade association. |
| U.S. Chamber of Commerce, American Chemistry Council, American Coke and Coal Chemicals Institute, American Forest & Paper Association, American Fuel & Petrochemical Manufacturers, American Petroleum Institute, Association of Home Appliance Manufacturers, Brick Industry Association, Council of Industrial Boiler Owners, National Association of Home Builders, National Association of Manufacturers, National Mining Association, National Oilseed Processors Association, Portland Cement Association. | U.S. Chamber of Commerce | Trade association. |
| U.S. Small Business Administration's Office of Advocacy | Advocacy | Government agency. |
| Vermont Energy Investment Corporation | VEIC | Efficiency organization. |
| West Virginia Housing Institute, Inc. | WVHI | Trade association. |
| Window and Door Manufacturers Association | WDMA | Trade association. |

DOE also received over 700 substantively similar form letters from individuals. All of the comment submissions are available in the docket for this rulemaking. The comments and DOE's responses are discussed in sections III, IV, and V of this document.

4. Development of the Current Proposal

DOE received a number of responses to its June 2016 NOPR. In response to concerns related to potential adverse impacts on price-sensitive, low-income purchasers of manufactured homes from the imposition of energy conservation standards on manufactured housing, DOE sought additional information from the public regarding these impacts by publishing the August 2018 NODA. See 83 FR 38073 (August 3, 2018). That NODA indicated that DOE had re-examined its available data and re-evaluated its approach in developing standards for manufactured housing. The August 2018 NODA also indicated that HUD had made DOE aware of the adverse impacts on manufactured housing affordability that would likely follow if DOE were to adopt the approach laid out in its June 2016 NOPR. See 83 FR 38073, 38075. These discussions with HUD, along with a concern over the initial first-cost impacts that DOE's earlier proposal would have on low-income buyers, led DOE to examine a potential tiered proposal that would require varying levels of energy efficiency performance with specified increases in incremental upfront-costs that would still improve the overall energy efficiency of manufactured homes. See 83 FR 38077.

DOE has not included test procedure or compliance and enforcement provisions in this SNOPR. DOE also has not included provisions related to waivers or exception relief that might be available to manufacturers regarding compliance with any standards that DOE may adopt. DOE does not intend to address test procedures or compliance and enforcement provisions in this rulemaking. DOE notes that HUD has an established design approval, monitoring and enforcement system, defined in 24 CFR part 3282, that is robust and provides compliance and enforcement of the manufactured housing industry standards. Moreover, manufacturers must comply with referenced standards incorporated by HUD in its regulations. While DOE would consider HUD's established compliance and enforcement mechanism appropriate to support any standards HUD incorporates by reference from any final

manufactured housing rule, DOE is seeking comment on such an approach. DOE intends to continue consulting with HUD on potential approaches and is seeking comment on other potential approaches to compliance with, and enforcement of, a final energy conservation standard for manufactured housing.

## III. Discussion of the Proposed Standards

### *A. The Basis for the Proposed Standards*

1. Scope

DOE's authority under 42 U.S.C. 17071 to establish energy conservation standards for manufactured homes specifies that those standards ''shall be based on'' the most recent version of the IECC. Because the IECC is specific to site-built structures, DOE's supplemental proposal, while based on the 2021 IECC, has required modifications to IECC provisions for application to manufactured homes. In DOE's view, the language Congress used in instructing DOE to set standards for these structures is broad and does not require the imposition of requirements for manufactured homes that are identical to those that IECC provides for site-built structures. The use of the phrase ''based on'' readily indicates that Congress anticipated that DOE would need to use its discretion in adapting elements of the IECC's provisions for manufactured housing use, including whether those elements would be appropriate in light of the specific circumstances related to the structure. Further, Congress indicated that DOE has discretion to depart from the IECC to the extent it is not cost-effective.

Pursuant to this discretion afforded by Congress, as opposed to complete adoption of the 2021 IECC, DOE is proposing, first, a tiered standard whereby manufactured homes with manufactured retail list prices of $55,000 or less (''Tier 1'' manufactured homes) would be subject to different building thermal envelope requirements (subpart B of proposed 10 CFR part 460) than all other manufactured homes (''Tier 2'' manufactured homes). Both tiers are based on the 2021 IECC in that both tiers have requirements for the building thermal envelope, duct and air sealing, installation of insulation, HVAC specifications, service hot water systems, mechanical ventilation fan efficacy, and heating and cooling equipment sizing provisions of the 2021 IECC. However, in light of cost-effectiveness concerns, Tier 1 provides tailored improvements in efficiency with regard to building thermal envelope, which are projected to result in an approximately $750 incremental price increase. Tier 2 focuses on the building thermal envelope, duct and air sealing, insulation installation, HVAC specifications, service hot water systems, mechanical ventilation fan efficacy, and heating and cooling equipment sizing provisions, based on the 2021 IECC, and is estimated to result in an average incremental price increase of $3,900–$5,300 for single- and multi-section homes, respectively. As an alternative, DOE is also proposing a single, untiered standard for manufactured homes that is the same as the Tier 2 standard.

In establishing standards for manufactured housing, Congress directed DOE to: (1) Consult with the Secretary of HUD (42 U.S.C. 17071(a)(2)(b)), and (2) base the standards on the most recent version of the IECC, except in cases in which the Secretary finds that the code is not cost-effective, or a more stringent standard would be more cost-effective, based on the impact of the codeon the purchase price of manufactured housing and on total life-cycle construction and operating costs. (42 U.S.C. 17071(b)(1)) Relatedly, the Secretary of HUD is mandated to establish standards for manufactured housing that, in part, ''ensure that the public interest in, and need for, affordable manufactured housing is duly considered in all determinations relating to the Federal standards and their enforcement.'' (42 U.S.C. 5401(b))

In this consultative role, HUD raised a concern with the potential adverse impacts on manufactured housing affordability that could result from additional energy efficiency standards being established for manufactured homes. More specifically, HUD noted concerns that increases in the purchase prices for manufactured homes resulting from the costs of requiring to meet standards based upon the IECC could result in prospective manufactured homeowners being unable to purchase a manufactured home. With this concern in mind, in the August 2018 NODA, DOE requested comment on a report released in 2014 from the Consumer Financial Protection Bureau (''CFPB'') indicating manufactured housing purchasers face substantial constraints compared to traditional home purchasers.[14] 83 FR 38073, 38076. As discussed in the August 2018 NODA, the report, ''Manufactured-Housing Consumer Finance in the United States,'' (hereinafter, ''CFPB Report'') presented the following key findings:

- Manufactured home ownership varies widely by region, with the majority of manufactured homes located outside of metropolitan areas;
- Manufactured home owners tend to have lower incomes and less net worth than their counterparts who own site-built homes;
- There is an extremely constrained secondary market for manufactured homes, following the collapse of the manufactured home market in the late 1990s through the early 2000s;
- Most manufactured-housing purchasers who finance their homes obtained a loan of between $10,000 and $80,000, with a median loan value of $55,000.

These constraints may make purchasers of manufactured homes more price sensitive to potential changes that would impact the costs to construct (and purchase) a manufactured home. Moreover, the CFPB Report suggests that manufactured home consumers are particularly cost-driven.[15]

The CFPB Report stated that the median annual income of families living in manufactured homes is slightly over $26,000, and the median net worth of these families is $26,000 (a quarter of the median net worth for families in site-built homes). *See id.* at 16–18.

Additionally, owners of manufactured homes who finance their homes tend to pay higher interest rates than their site-built home counterparts. A key reason for this difference is that the vast majority of manufactured housing stock is titled as chattel (*i.e.* personal property), and as a result is eligible only for chattel financing. Chattel financing is typically offered to purchasers at a significantly higher interest rate than the rates offered to site-built home owners. While most manufactured home

[14] See *https://files.consumerfinance.gov/f/201409_cfpb_report_manufactured-housing.pdf.*

[15] In particular, the report noted: ''There is evidence that some households who move into manufactured housing are less satisfied with their homes than those who choose to move into site-built housing. These results suggest that for at least some households, the choice to live in a manufactured home may be more cost-driven than quality-driven.'' CFPB Report at 22.

owners who also own the land on which the manufactured home is sited may be eligible for mortgage financing, there is a tradeoff between lower origination costs with significantly higher interest rates (chattel loans) and higher origination costs with significantly lower interest rates and greater consumer protections (mortgage). *See id.* at pp. 23–25.

Therefore, in response to the affordability concerns raised by HUD and commenters, DOE is contemplating whether there are cost-effective approaches that would also mitigate first-cost impacts for purchasers at the lower end of the manufactured home price range. Accordingly, DOE is presenting a tiered proposal that would provide in proposed subpart B tiered standards based on a manufacturer's retail list price. According to 2019 data, the average purchase price (*i.e.,* sales price if the home is intended for sale) of a single section manufactured home is $53,200, the average purchase price of a multi-section manufactured home is $104,000, and the average purchase price of all manufactured homes is $81,900.[16] To the extent that manufactured home purchasers are cost-driven, in conjunction with the lower median income and net worth of these purchasers, consumers at the lower end of the manufactured home purchase price range generally would be more sensitive to increases in purchase price. Accordingly, DOE created a tiered proposal to address affordability issues associated with the full implementation of the 2021 IECC in the untiered proposal.

Accordingly, under the tiered proposal, the stringency of the standards under proposed subpart B applicable to Tier 1 manufactured homes (*i.e.,* manufactured homes with a manufacturer's retail list price of $55,000 or less) would require building thermal envelope measures that would result in an incremental purchase price increase of approximately $750. Section III.A.2 provides further discussion on how the manufacturer's retail list price tier threshold and $750 incremental purchase price were developed.

DOE estimates the SNOPR would result in a loss in demand and availability of about 53,329 homes (single section and multi-section combined) for the tiered standard and about 71,290 homes (single section and multi-section combined) for untiered standards based on a price elasticity of demand of –0.48 for the analysis period (2023–2052). Out of the 53,329 homes in the tiered standard, the majority of the reduction is in Tier 2 (93 percent) vs. Tier 1 (7 percent). Within Tier 1, DOE estimates a 0.52 percent reduction (essentially no reduction) in availability due to Tier 1 standards for low income purchasers. Table III.1 provides a summary of the change in shipments for tiered standards. See section IV.c.1.b. for a discussion of price elasticity with respect to manufactured housing shipments and people who do not buy because they are price-sensitive.

TABLE III.1—CHANGE IN SHIPMENTS FOR TIERED STANDARDS *

| | No-standards shipments | | Standards case shipments | | Change in shipments, tiered | | |
|---|---|---|---|---|---|---|---|
| | Tier 1 | Tier 2 | Tier 1 | Tier 2 | Tier 1 | Tier 2 | Total |
| 30-year analysis | 703,725 | 2,086,927 | 700,032 | 2,037,291 | (3,693) | (49,636) | (53,329) |
| Annual | | | | | (123) | (1,655) | (1,778) |

* Values in parenthesis are negative.

As a sensitivity, DOE also considered a price elasticity of demand of –2.4 instead of –0.48. Further discussion on this sensitivity is provided in section IV.C.2 of this document. Table III.2 provides a summary of the change in shipments for tiered standards for price elasticity of –2.4 instead of –0.48.

TABLE III.2—CHANGE IN SHIPMENTS COMPARED TO BASELINE, −0.48 AND −2.4 PRICE ELASTICITY

| | Change in shipments,–0.48 price elasticity | | | Change in shipments,–2.4 price elasticity | | |
|---|---|---|---|---|---|---|
| | Tier 1 | Tier 2 | Total | Tier 1 | Tier 2 | Total |
| 30-year analysis | (3,693) | (49,636) | (53,329) | (18,375) | (247,692) | (266,067) |
| Annual | (123) | (1,655) | (1,778) | (613) | (8,256) | (8,869) |

* Values in parenthesis are negative.

On May 27, 2021, the CFPB issued another report entitled ''Manufactured Housing Finance: New Insights from the Home Mortgage Disclosure Act Data'' (the ''2021 CFPB Report'').[17] DOE is aware of the 2021 CFPB report, but has not yet reviewed it in detail. Accordingly, DOE did not incorporate any new or additional data from the 2021 CFPB report into the analysis presented in this SNOPR. DOE is also aware that the U.S. Census has released the 2020 Manufactured Housing Survey,[18] but similarly has not reviewed the results in detail or incorporated these new data into the analysis presented here. DOE welcomes comment on the use of the data in 2021 CFPB report and the 2020 Manufactured Housing Survey in DOE's analyses for this rulemaking.

DOE invites comment on whether (1) the manufacturer's retail list price threshold for Tier 1 under the tiered proposal is appropriate, (2) the untiered proposal in this SNOPR is cost-effective, generally, and (3) the untiered proposal is cost-effective for low-income consumers.

Finally, the scope proposed in this document provides additional clarification that the proposed energy conservation standards would apply to the design, construction and aspects of onsite completion of manufactured

[16] Manufactured Housing Survey 2019; U.S. Census Data; *https://www.census.gov/data/tables/time-series/econ/mhs/annual-data.html.*

[17] The report may be found at: *files.consumerfinance.gov/f/documents/cfpb_manufactured-housing-finance-new-insights-hmda_report_2021-05.pdf.*

[18] *https://www.census.gov/data/tables/time-series/econ/mhs/annual-data.html.*

homes—not to the installation of a home.

On November 9, 2016, DOE published a NOPR for test procedures (2016 Test Procedure NOPR), as a companion to the draft energy efficiency standards rule for manufactured housing. See 81 FR 78733 (November 9, 2016). The 2016 Test Procedure NOPR proposed procedures for how those subject to energy conservation standards for manufactured housing would confirm products are in compliance with the standards. More specifically, the 2016 Test Procedure NOPR proposed procedures to determine compliance with the following metrices from the June 2016 NOPR: The R-value of insulation; the U-factor of windows, skylights, and doors; the solar heat gain coefficient of fenestration; U-factor alternatives to R-value requirements; the air leakage rate of air distribution systems; and mechanical ventilation fan efficacy. 81 FR 78733. A discussion of the 2016 Test Procedure NOPR may be found in section III.C of this document.

DOE is not addressing a test procedure, or compliance and enforcement provisions for an energy conservation standard for manufactured housing in this document. DOE continues to consult with HUD about pathways to address testing, compliance and enforcement for this proposed standard in a manner consistent with the current HUD inspection and enforcement process so that such testing, compliance and enforcement procedures are not overly burdensome for manufacturers. While many of the requirements in the proposed standard and alternative proposal would require minimal compliance efforts and costs (*e.g.,* documenting the use of materials subject to separate Federal or industry standards, such as the R-value of insulation or U-factor values for fenestration), DOE acknowledges that it has not fully enumerated testing and enforcement costs at this time. However, because testing and compliance and enforcement requirements may be dependent upon the final outcome of this rulemaking, DOE is not proposing any testing, compliance or enforcement provisions at this time. DOE has also not included any potential associated costs of testing, compliance or enforcement. DOE intends to continue working with HUD on potential approaches and is seeking comment on other potential approaches for testing, compliance and enforcement that will ensure manufacturer compliance with the standard in a manner that is not overly burdensome or costly to manufacturers.

DOE welcomes comment on approaches for testing, compliance and enforcement provisions for the proposed standards and alternative proposal. DOE also welcomes comments and information related to potential testing, compliance and enforcement under the current HUD inspection and enforcement process, and potential costs of testing, compliance and enforcement of the proposed standards and alternative proposal in this document.

2. Proposed Standards

EISA requires DOE to base standards for manufactured housing on the IECC. However, application of the IECC standards is also subject to a number of considerations set forth by the statute in order to ensure standards will be appropriately tailored for manufactured homes and the manufactured home market. Specifically, EISA requires that DOE establish energy conservation standards for manufactured housing that are ''based on the most recent version of the [IECC], except in cases in which [DOE] finds that the [IECC] is not cost-effective, or a more stringent standard would be more cost-effective, based on the impact of the [IECC] on the purchase price and on total life-cycle construction and operating costs.'' (42 U.S.C. 17071(b)(1)).

In addition to the required cost-effectiveness considerations, EISA explicitly allows DOE to consider the differences in design and factory construction techniques of manufactured homes, as compared to site-built and modular homes. (42 U.S.C. 17071(b)(2)) As noted in section II.B.2, the 2021 IECC applies generally to residential buildings, including site-built and modular housing, and is not specific to manufactured housing. The energy conservation standards proposed in this SNOPR are generally based on certain specifications included in the 2021 IECC while also accounting for the unique aspects of manufactured housing. DOE carefully considered the following aspects of manufactured housing design and construction in developing the standards:

- Manufactured housing structural requirements contained in the HUD Code;
- External dimensional limitations associated with transportation restrictions;
- The need to optimize interior space within manufactured homes; and
- Factory construction techniques that facilitate sealing the building thermal envelope to limit air leakage.

Upon consideration of these aspects of manufactured housing design and construction, DOE is not proposing to include several of the 2021 IECC requirements such as more stringent ceiling *R*-value requirements (greater than *R*-38) in the northern climate zones and the requirement for the exterior ceiling insulation to be of uniform thickness or uniform density given the space constraints of manufactured homes (discussed in further detail in section III.E.2.b).

EISA also allows DOE to base standards on the climate zones of the HUD Code instead of the IECC. (42 U.S.C. 17071(b)(2)(B)) There are differences in the number and boundaries of the HUD zones as compared to the IECC climate zones. For example, under the 2021 IECC climate zone map, California is divided into five climate zones (including zone variation based on moisture regimes), with four of the zones subject to SHGC maximums (0.40 applicable to climate zones 4 and 5, and 0.25 applicable to climate zones 2 and 3). Under the HUD zone map, all of California is within a single zone. Developing energy conservation standards based on the HUD climate zones, as DOE is proposing to do in this SNOPR and as permitted under EISA, necessitates deviating from the IECC. The updated proposal would establish thermal envelope requirements, as does the 2021 IECC, but setting the values for those requirements necessitates that DOE develop standard levels different than those in the 2021 IECC to account for the difference in the number of climate zones.

In addition, DOE has conducted a sensitivity analysis for an alternative exterior insulation requirement, R–21, for Tier 2 in zones 2 and 3. This alternative insulation requirement is based on (but not identical to) the 2021 IECC, which includes a requirement for continuous insulation (R–20+5). DOE developed this sensitivity analysis to evaluate the effects on life-cycle costs and payback period for Tier 2 consumers. This sensitivity analysis is further discussed in section IV.A.2 of this document.

In modifying the IECC requirements, DOE relied, in part, on the statutorily required interagency consultation with HUD. As discussed, the HUD consultation ensures that DOE is informed by HUD's expertise and statutory duties as they pertain to the role of manufactured housing in the U.S. housing market, as recognized by Congress. As a result of concerns raised by HUD regarding the need to maintain affordability, which interrelate with the cost-effectiveness concerns specified in 42 U.S.C. 17071, DOE is presenting a primary proposal based on tiered standards that would prescribe a complement of cost-effective energy

conservation requirements based on requirements in the 2021 IECC.

The proposed Tier 1 standards would apply to manufactured homes with a manufacturer's retail list price of $55,000 or less (in real 2019$). The proposed Tier 1 requirements incorporate IECC-based building thermal envelope component measures that result in an incremental purchase price increase of approximately $750. The proposed Tier 2 standards would apply to manufactured homes with a manufacturer's retail list price that is greater than $55,000 (in real 2019$). The Tier 2 standards would be based on the most recent version of the IECC, with consideration of the design and factory construction techniques of manufactured homes. As an alternative, DOE also proposes an untiered standard in which all manufactured homes would be at the same stringencies as the standards based on the most recent version of the IECC, similar to the Tier 2 standard.

a. Manufacturer's Retail List Price Tier Threshold

The proposed manufacturer's retail list price tier threshold for the tiered standard was developed using loan and manufactured home purchase price data. The loan data were derived from the CFPB report.[19] The purchase price data were derived from the manufactured housing survey (''MHS'') 2019 public use file (''PUF'') data, which provide estimates of average sales prices for new manufactured homes sold or intended for sale by geographical region and size of home.[20] The CFPB report states that high-priced manufactured housing loans (including chattel loans) account for roughly 68 percent of total manufactured housing loans.[21] If people typically receive one primary loan, the percentage of high-priced loans used should roughly equal the percentage of people receiving high-priced loans and, thus, homes purchased with high-priced loans (*i.e.,* 68 percent). Assuming that price-sensitive, low-income purchasers rely on high-priced loans, and pairing the CFPB figure with the MHS 2019 PUF data, the 68th percentile manufactured housing price gives a reasonable estimate for the upper bound for a manufactured home sales price that a price-sensitive low-income purchaser would pay. DOE considered that low-income purchasers would mainly purchase single-section homes that are, on average, at a lower sales price than multi-section homes. Accordingly, applying the 68th percentile for a single-section manufactured home using the MHS 2019 PUF data, yields a sales price of approximately $55,000. This price serves as the proposed threshold for Tier 1. Using this threshold, Tier 1 consists of approximately 25 percent of the total sales (single-section and multi-section) of manufactured homes. Tier 2 consists of approximately 75 percent of the sales total (single-section and multi-section) of manufactured homes.

DOE acknowledges that the boundary of the proposed tiers is being applied to manufacturers' retail list prices, while the underlying data from which the boundary is derived in the MHS 2019 PUF data are sales and/or purchase price data of manufactured homes. DOE understands the manufacturer's retail list price to be the price that the manufacturer provides in the sales contract to a distributor or retailer—*i.e.,* the price that the manufactured home is originally listed at by the manufacturer. On the other hand, the purchase price is the final sales price of the home to the consumer. The manufacturer's retail list price and the purchase price are not the same. However, the MHS 2019 PUF purchase price data are the most robust and reliable data of the manufactured housing market that, to date, DOE has found in its own search, or that has been provided to DOE. DOE believes these data are still largely representative of the overall manufactured housing market and that the tiers are appropriately set based on this data.

DOE believes the proposed threshold based on manufacturer's retail list price can sufficiently address the affordability concerns previously expressed by HUD and other stakeholders. DOE also notes that, based on its understanding of the MHS 2019 PUF data, the proposed $55,000 threshold would not vary significantly across regions. Although DOE is proposing a national retail price-based threshold, in consultations with HUD and the MHCC, DOE received comments and questions regarding the use of alternative metrics upon which to base the boundary between tiers, such as the size of the manufactured home. Accordingly, DOE also considered other threshold types that would be based on size (*e.g.,* square footage or for single-section vs. multi-section homes) or region (*e.g.,* retail price thresholds tailored to specific regions rather than a single national value). For example, the MHS 2019 PUF data set provides data that relates home size (in terms of square feet) with purchase price. Table III.3 summarizes the average, minimum and maximum sales prices based on home size using square footage and section. In general, the data indicates that while price increases with home size, the minimum and maximum prices do not vary significantly with home size (with certain exceptions).

TABLE III.3—MHS PUF 2019 HOME SIZE AND SALES PRICE DATA

| Home size (square feet) | Single-section sales price (2019$) | | | Dual-section sales price (2019$) | | |
|---|---|---|---|---|---|---|
| | Average | Minimum | Maximum | Average | Minimum | Maximum |
| 440–539 | $36,786 | $28,400 | $53,000 | ..... | ..... | ..... |
| 540–639 | 46,769 | 29,600 | 100,000 | ..... | ..... | ..... |
| 640–739 | 45,012 | 32,100 | 100,000 | ..... | ..... | ..... |
| 740–839 | 49,011 | 28,400 | 101,000 | ..... | ..... | ..... |
| 840–939 | 44,497 | 28,400 | 101,000 | $90,274 | $60,000 | $226,000 |
| 940–1039 | 49,943 | 32,100 | 101,000 | 87,596 | 55,000 | 156,000 |
| 1040–1139 | 52,698 | 29,600 | 101,000 | 79,413 | 52,000 | 226,000 |
| 1140–1239 | 57,330 | 29,600 | 101,000 | 94,153 | 54,000 | 256,000 |
| 1240–1339 | 59,781 | 28,400 | 100,000 | 84,873 | 52,000 | 256,000 |
| 1340–1439 | 63,848 | 39,000 | 74,000 | 105,697 | 54,000 | 256,000 |
| 1440–1539 | ..... | ..... | ..... | 97,973 | 52,000 | 256,000 |
| 1540–1639 | ..... | ..... | ..... | 94,109 | 52,000 | 256,000 |

[19] CFPB report, 2014. *https://files.consumerfinance.gov/f/201409_cfpb_report_manufactured-housing.pdf.* At the time of this analysis, the 2014 CFPB report was the latest that was available.

[20] Manufactured Housing Survey, Public Use File (PUF) 2019. *https://www.census.gov/data/datasets/2019/econ/mhs/puf.html.*

[21] The Consumer Finance Protection Bureau (CFPB) in general describes a higher-priced mortgage loan as a loan with an annual percentage rate, or APR, higher than a benchmark rate called the Average Prime Offer Rate. The requirements for this loan can be found in 12 CFR 1026.35.

TABLE III.3—MHS PUF 2019 HOME SIZE AND SALES PRICE DATA—Continued

| Home size (square feet) | Single-section sales price (2019$) | | | Dual-section sales price (2019$) | | |
|---|---|---|---|---|---|---|
| | Average | Minimum | Maximum | Average | Minimum | Maximum |
| 1640–1739 | | | | 101,684 | 52,000 | 256,000 |
| 1740–1839 | | | | 109,921 | 52,000 | 256,000 |
| 1840–1939 | | | | 103,365 | 60,000 | 226,000 |
| 1940–2039 | | | | 105,981 | 52,000 | 256,000 |
| 2040–2139 | | | | 117,584 | 52,000 | 226,000 |
| 2140–2239 | | | | 118,631 | 52,000 | 226,000 |
| 2240–2339 | | | | 122,939 | 79,000 | 164,000 |
| 2340–2439 | | | | 136,305 | 103,000 | 162,000 |
| 2440–2539 | | | | 136,428 | 60,000 | 226,000 |
| All | 53,246 | 28,400 | 101,000 | 104,006 | 52,000 | 256,000 |

The MHS 2019 PUF data set also provides data that relates Census region (the U.S. Census Bureau divides the country into four census regions) with purchase price. Table III.4 summarizes the average, minimum and maximum sales prices based on census region and section. In general, the data indicates that average price (specifically for single-section homes) does not differ significantly based on census region.

TABLE III.4—MHS PUF 2019 CENSUS REGION AND SALES PRICE DATA

| Census region | Single-section sales price (2019) | | | Dual-section sales price (2019) | | |
|---|---|---|---|---|---|---|
| | Average | Minimum | Maximum | Average | Minimum | Maximum |
| Northeast | $54,430 | $33,800 | $101,000 | $106,502 | $55,000 | $256,000 |
| Midwest | 54,025 | 32,100 | 75,000 | 98,512 | 54,000 | 162,000 |
| South | 52,879 | 29,600 | 74,000 | 102,222 | 52,000 | 164,000 |
| West | 53,318 | 28,400 | 100,000 | 113,312 | 60,000 | 226,000 |
| All | 53,246 | 28,400 | 101,000 | 104,006 | 52,000 | 256,000 |

At this time, DOE has tentatively determined that a national retail price-based threshold will accomplish the purposes of EISA while taking into account the importance of affordable housing. However, DOE is considering conducting additional analyses on alternative thresholds prior to the final rule stage. DOE requests comment on this approach and whether other types of thresholds are worth considering for the final rule stage.

DOE requests comment on the use of a tiered approach to address affordability and PBP concerns from HUD, other stakeholders, and the policies outlined in Executive Order 13985. DOE also requests comment regarding whether the price point boundary between the proposed tiers is appropriate, and if not, at what price point should it be set and the basis for any alternative price points. DOE also requests comment on its assumptions regarding the use of high-priced loans (*e.g.,* chattel loans) by low-income purchasers, or other purchasers, of manufactured housing.

DOE also requests comment on alternate thresholds (besides price point) to consider for the tiered approach, including a size-based threshold (*e.g.,* square footage or whether a home is single- or multi-section). DOE requests comment on the square footage and region versus sales price data provided in the notice (from MHS PUF 2019) and how that data (or more recent versions of that data) could be used to create either a size-based or region-based threshold instead. DOE further requests input on whether there should be single national threshold as proposed, or whether it should vary based on geography or other factors, and if so, what factors should be considered.

As mentioned previously, the threshold proposed in this SNOPR is based in real 2019 dollars. Accordingly, DOE also proposes under the tiered proposal that the manufacturer's retail list price thresholds would be adjusted for inflation (for the applicable year of compliance) using the most recently available Annual Energy Outlook (''AEO'') GDP deflator time series. For AEO 2020, Table III.5 provides the values of the GDP deflator time series.[22]

[22] See Table 20. Macroeconomic Indicators; GDP Chain-type Price Index; Reference case.

TABLE III.5—AEO 2020 GDP DEFLATOR

| | GDP deflator |
|---|---|
| 2019 | 1 |
| 2020 | 1.024394 |
| 2025 | 1.152839 |
| 2030 | 1.296141 |
| 2035 | 1.445744 |
| 2040 | 1.614055 |
| 2045 | 1.809366 |
| 2050 | 2.041051 |

DOE requests comment on using the AEO GDP deflator series to adjust the manufacturer's retail list price threshold for inflation. DOE requests comment on whether other time series, including those that account for regional variability, should be used to adjust manufacturer's retail list price.

b. Tier Proposals

The proposed lower incremental purchase price for manufactured homes covered by the Tier 1 standard was developed in response to concerns from HUD and other commenters regarding the incremental purchase price, and the ability of the first homeowner/purchaser for these homes to recoup the increase in purchase price and realize the savings offered by the greater energy

efficiency of a Tier 1 manufactured home. As discussed in section IV.A.1.a, several commenters expressed concern that first homeowners of manufactured homes would not live in the homes long enough to recoup the increases in purchase price or realize the energy savings of the energy efficiency measures proposed in the June 2016 NOPR.

In determining the energy efficiency measure (EEM) combinations, DOE ensured that the performance-based overall thermal transmittance (*Uo*) for these combinations would be more stringent than the current HUD requirements. DOE's objective in defining the Tier 1 incremental purchase price threshold was based on which threshold a low-income buyer purchasing a single-section home (using typical loan terms available to these homebuyers, primarily chattel loans with higher interest rates) would, on average, realize a positive cash flow within Year 1 of the standard based on the down payment, incremental loan payment, and energy cost savings. As such, DOE preliminarily determined that an incremental purchase price of no more than $750 provided a beneficial financial outcome for these consumers given lifecycle cost savings and energy cost savings, while minimizing first cost impacts. Specifically, for single-section manufactured homes, DOE determined the set of energy efficiency measures with an average incremental purchase price of $663 (as presented in Table I.1) with a 10 percent down payment (using a chattel loan, as discussed in section IV.A.1.d) would, on average, result in a positive cash flow within the first year, as presented in Table III.6. Further discussion on the LCC inputs to this subgroup calculation are presented in section Chapter 9 of the TSD.

TABLE III.6—TIER 1 LCC SUB-GROUP NATIONAL RESULTS

| Single-section only; 30-year analysis period; national results | Tier 1 |
|---|---|
| Incremental cost | $662.64 |
| Down-payment (10%) | 66.26 |
| Yearly Incremental Loan Payment | 78.55 |
| First Year Incremental Payment (Down-payment + Loan) | 144.81 |
| Yearly Energy Cost Savings | 180.83 |
| First Year Savings (Energy Cost Savings − Incremental Payment) | 36.01 |

Accordingly, by focusing the Tier 1 standards on those measures that would result in an incremental purchase price increase of approximately $750, DOE proposes a way to take into account energy efficiency and cost-effectiveness in a manner consistent with the statute. Further discussion is provided in Chapter 6 of the TSD.

The proposed Tier 2 standard would be at the same stringencies as the standards based on the most recent version of the IECC, with consideration of cost-effectiveness and design and factory construction techniques of manufactured homes. (42 U.S.C. 17071(b)(1); 42 U.S.C. 17071(b)(2)(A)) The proposed building thermal envelope requirements for both tiers are presented in section III.E.2.b of this document.

c. General Comments to the June 2016 NOPR on Energy Conservation Standards

This SNOPR reflects general comments to the June 2016 NOPR regarding the need to update the energy conservation standards for manufactured homes and the basis for any standards established. MHARR stated that HUD-regulated manufactured homes are already energy efficient, with median monthly energy costs that are either lower or comparable to the median monthly costs for site-built homes, without high costs to the consumer. (MHARR, No. 143 at p. 4) Next Step cited a study done by the American Council for Energy Efficient Economy (''ACEEE'') that found that residents of manufactured homes spend 30 percent more income on energy than the average American household and 66 percent more than owners of site-built homes. (Next Step, No. 174 at p. 1)

DOE also received several comments regarding the use of the IECC as a basis for this rulemaking. SBRA stated that the IECC is a weak regulatory basis for developing manufactured housing standards, as IECC is not developed with cost-effectiveness as a primary consideration. SBRA recommended that in the future, DOE base changes to energy conservation standards for manufactured housing primarily on methods and practices specific to the MH industry. (SBRA, No. 163 at p. 1)

As described in section II.A, EISA mandates that the manufactured housing energy conservation standards be based upon the most recent IECC, except in cases in which the Secretary finds that the IECC is not cost-effective, or a more stringent standard would be more cost-effective, based on the impact of the IECC on the purchase price of manufactured housing and on total life-cycle construction and operating costs. (42 U.S.C. 17071(b)(1)) As discussed, DOE evaluated the requirements of the IECC along with the other considerations enumerated by EISA. EISA also requires DOE to update the energy conservation standards no later than one year after any revisions to the IECC; therefore, future revisions to the standards will also be based on the IECC along with the other considerations identified by EISA. In this SNOPR, DOE proposes to include several IECC provisions with modification, incorporating some of the MH working group's recommendations that were based on cost-effectiveness. DOE also proposes to include modified IECC provisions to make the DOE standards better tailored to the manufactured housing industry, as discussed in further depth in the next paragraphs.

Regarding the statutory requirement to base standards on the IECC, the ICC stated in its comments that its codes generally do not apply rules that distinguish among buildings based on their structure or how they were built. ICC went on to state that it understands there may be technical reasons that warrant modifying the IECC standards, but it asserted that those changes should be based on a showing of impossibility and incompatibility with the manufactured housing process. (ICC, No. 160 at p. 2)

One of the considerations provided by EISA in establishing standards is ''the design and factory construction techniques of manufactured homes.'' (42 U.S.C. 17071(b)(2)(A)) The design and construction of manufactured homes was a main focus of the MH working group while developing the recommendations that DOE has considered in this rulemaking. For example, section R402.2.4 of the 2015 IECC (which was considered by the MH working group) and the 2021 IECC (which is the latest version of the IECC and considered in this SNOPR) include

a specification for vertical doors that provide access from conditioned to unconditioned spaces to meet certain fenestration insulation requirements. However, doors that separate conditioned and unconditioned space rarely are relevant to manufactured homes. Therefore, the MH working group recommended that this provision be removed from the energy conservation standards as it was deemed not relevant to manufactured housing design and construction. Modifications to the IECC in this proposal were based on unique, technical aspects of the manufactured housing industry, as well as use of the HUD zones and to address cost-effectiveness concerns related to the potential impact cost increases would have on the affordability of the manufactured housing market.

Additionally, as noted previously, the authority under 42 U.S.C. 17071 to establish energy conservation standards for manufactured homes specifies that those standards ''shall be based on'' the most recent version of the IECC. In DOE's view, this does not require the energy conservation standards for manufactured homes to be an identical or verbatim equivalent of the IECC, especially in light of the other considerations DOE must make under the statute (*i.e.,* the design and construction techniques of manufactured homes, cost-effectiveness, etc.). Because the IECC is specific to site-built structures, both approaches proposed in this document would establish requirements using modified versions of those related IECC provisions that can be adapted for manufactured homes.

In another comment regarding the IECC, VEIC commented that DOE should include a provision to regularly update the standards with changes made to the IECC in the future. (VEIC, No. 187 at p. 2) In response, DOE notes that EISA already requires the agency to update its energy conservation standards for manufactured housing not later than ''one year after any revision to the IECC.'' (42 U.S.C. 17071(b)(3)(B)) DOE has considered the latest version of the IECC (the 2021 IECC) for this SNOPR, and is proposing energy conservation standards based on the latest version of the IECC. DOE will review subsequent IECC standards issued in the future and evaluate whether to update the energy conservation standards for manufactured housing based on the considerations required by EISA.

Southern Company questioned whether the new regulations are subject to the seven-factor test for cost-effectiveness as found in 10 CFR part 430. (Southern Company, Public Meeting Transcript, No. 148 at p. 143) DOE understands the question from Southern Company to refer to the seven statutory factors, as described in 42 U.S.C. 6295(o)(2)(B)(i)(I)–(VII), that apply to energy conservation standards established under the Energy Conservation Program for Consumer Products Other than Automobiles (Title III, Part B of the Title III, Part B of the Energy Policy and Conservation Act of 1975 (EPCA)). Manufactured housing is not a covered product under Title III, Part B of EPCA, and is subject to a separate statutory scheme (*i.e.,* 42 U.S.C. 17071). Therefore, this rulemaking is not directly subject to the EPCA seven-factors test, although similar analyses have been conducted for this rulemaking (*e.g.,* LCC, MIA).

*B. Rulemaking Process*

As part of developing energy conservation standards for manufactured housing, DOE is undertaking a multi-stage process providing numerous opportunities for public comment and engagement, as discussed in further detail in section II.B.3 of this document. For this rulemaking, EISA requires DOE to ''consult with the Secretary of HUD, who may seek further counsel from the Manufactured Housing Consensus Committee''. 42 U.S.C. 17071(a)(2)(B). Pursuant to the statutory requirement, DOE has consulted with HUD throughout the development of these standards, as discussed in section II.B.3. DOE met with HUD multiple times during the preliminary stages of the proposed rule, as well as throughout the rest of the rulemaking process, and consulted HUD in the development of the proposals in this SNOPR. As EISA expressly states that the Secretary of HUD may engage with the MHCC with regard to this rulemaking, DOE has attended three MHCC meetings, most recently in June of 2021, to gather further information and input on the rule. This proposed rule includes a number of the changes submitted by the MHCC (MHCC, No. 162), which mirrored comments from other individual stakeholders on the June 2016 NOPR. A number of other stakeholders, including industry stakeholders, have also provided information, data, and opinions regarding the rule. All interested stakeholders will have the opportunity to provide input and comments on this SNOPR.

In response to the 2016 NOPR, DOE received several comments regarding the rulemaking process used by DOE for these energy conservation standards. MHARR had numerous comments regarding issues with the overall process used for this rulemaking. MHARR asserted that the DOE rulemaking process was not transparent, and that the proposed rule was a violation of the 1974 National Manufactured Housing Construction and Safety Standards Act; the ''arbitrary, capricious [or] abuse of discretion'' standard of the Administrative Procedure Act; the Negotiated Rulemaking Act; and EISA. (MHARR, No. 154 at pp. 2–15)

MHARR was also concerned that a 2011 draft of the proposed rule was distributed to a select group of organizations. MHARR stated that following this distribution, a ''fresh start'' was required for the proposed rule, but there is no evidence that a ''fresh start'' actually occurred. (MHARR, No. 154 at pp. 2–15; MHARR, No. 143 at pp. 1, 3; MHARR, Public Meeting Transcript, No. 148 at p. 149)

As stated earlier, DOE is conducting this rulemaking pursuant to the statutory provisions in EISA that direct DOE to establish energy conservation standards for manufactured housing. This statutory directive is separate from the 1974 National Manufacturing Housing Construction and Safety Standards Act that governs HUD's authority in promulgating regulations for manufactured housing. Additionally, DOE demonstrates in section III.F how the standards proposed in this SNOPR do not conflict with those established by HUD. Furthermore, this discussion and related supporting analyses together present the analytical approach used by DOE in evaluating the relevant information and on which DOE based its determinations regarding the proposed requirements in accordance with the directives in EISA, the Administrative Procedure Act and the Negotiated Rulemaking Act. Accordingly, as discussed previously, in preparation for the prior negotiated rulemaking that produced the June 2016 NOPR, DOE set up a negotiated rulemaking process in accordance with the Federal Advisory Committee Act and the Negotiated Rulemaking Act, which included a broad and balanced array of stakeholder interests and expertise, and included a representative from MHARR. 79 FR 41456 (July 16, 2014).

DOE also received several comments regarding the consensus approach used in the June 2016 NOPR. SBRA and Clayton Homes supported the ASRAC decision to use a consensus approach for this rulemaking and recommended DOE should continue this method for future rulemakings regarding

manufactured housing. (SBRA, No. 163 at p. 1; Clayton Homes, No. 185 at p. 5) DOE appreciates these comments supporting the use of a negotiated rulemaking process by DOE and will consider these and all other permissible options for future manufactured housing rulemakings.

With regard to the rulemaking process, DOE received several comments regarding the inclusion of the MHCC during the rulemaking. Several commenters stated that the proposed rule should not be finalized until the views and comments of MHCC are incorporated, as they have done for past HUD rulemakings. (Pleasant Valley Homes, No. 154 at p. 2; WVHI, No. 156 at p. 2; MHIM, No. 155 at p. 2; NMMHA, No. 157 at p. 2; MHIAZ, No. 161 at p. 2; PMHA, No. 164 at p. 2; Skyline Corporation, No. 165 at p. 1; OMHA, No. 166 at p. 2; MHI, No. 182 at p. 2; MMHA, No. 170 at p. 2; MHISC, No. 191 at p. 2; AMHA, No. 173 at p. 2, Commodore Corporation, No. 195 at p. 2) AMHA also stated that the proposed rule should not be finalized without thoughtful consideration of the detailed comments of professionals involved with manufactured housing including the MHCC, as well as MHARR and MHI. (AMHA, No. 173 at p. 3)

MHARR stated that DOE must consult with HUD and MHCC during the formulation of DOE standards, and that there is no evidence that these consultations ever occurred. (MHARR, No. 154 at p. 18) MHARR also commented that DOE never provided a chance for MHCC to provide substantive consensus input regarding the proposed rule and actively prevented any input from MHCC at any point when it would have mattered. (MHARR, No. 154 at p. 19) As stated previously, DOE has consulted both with HUD and engaged with the MHCC with regard to this rulemaking, and has incorporated information and considerations provided by HUD and the MHCC into this SNOPR.

*C. Test Procedure*

DOE published a test procedure NOPR for manufactured housing on November 9, 2016. 81 FR 78733 (November 2016 test procedure NOPR). The November 2016 test procedure NOPR proposed applicable test methods to determine compliance with the following metrics that were included in a June 2016 NOPR: the *R*-value of insulation; the *U*-factor of windows, skylights, and doors; the SHGC of fenestration; *U*-factor alternatives to *R*-value requirements; the air leakage rate of air distribution systems; and mechanical ventilation fan efficacy. The November 2016 test procedure NOPR proposed test methods that would dictate the basis on which a manufactured home's performance is represented and how compliance with the energy conservation standards would be determined. DOE notes that a number of the test methods that were proposed were consistent with test methods from the IECC, which includes test methods for *R*-value of insulation, *U*-factor and SHGC of fenestration, duct leakage and mechanical fan efficacy.

The November 2016 test procedure NOPR provided stakeholders an opportunity to comment on the proposed test procedure for manufactured housing. As discussed above, DOE is not addressing a test procedure in this rulemaking. DOE will consider the comments related to test procedures in any future action on test procedures.

*D. Certification, Compliance, and Enforcement*

In the November 2016 test procedure NOPR, DOE did not propose a system of certification, compliance, and enforcement (''CCE''), instead indicating those items would be addressed in a separate rulemaking. At this time, DOE is not addressing CCE issues in this rulemaking, but may do so in the future.

DOE received several comments identifying compliance and enforcement as a major issue that needs to be addressed. Several commenters stated that they are concerned that establishing standards prior to the establishment of a compliance regime would risk manufacturers facing complicated, conflicting, and overlapping requirements from both HUD and DOE. (Pleasant Valley Homes, No. 153 at p. 2; WVHI, No. 156 at p. 2; MHIM, No. 155 at p. 2; NMMHA, No. 157 at p. 2; MHIAZ, No. 161 at p. 2; OMHA, No. 166 at p. 2; MHCC, No. 162 at p. 2; MHI, No. 182 at p. 2; Clayton Homes, No. 185 at p. 1; Palm Harbor Homes, No. 193 at p. 3; MHISC, No. 191 at p. 2; AMHA, No. 173 at p. 2; Skyline Corporation, No. 165 at p. 2; NCJC, No. 184 at p. 2; Form Letters, No. 182 at p. 1; MHARR, No. 154 at p. 22) Commenters suggested that the proposed rule not be finalized until DOE and HUD can determine a single, efficient, and practical enforcement strategy, where HUD is the prime regulator. (MHI, Public Meeting Transcript, No. 148 at p. 11; MHI, Public Meeting Transcript, No. 148 at p. 142; Washington State University (WSU) Energy Program, Public Meeting Transcript, No. 148 at p. 146; Pleasant Valley Homes, No. 153 at p. 2; WVHI, No. 156 at p. 2; MHIM, No. 155 at p. 2; NMMHA, No. 157 at p. 2; MHIAZ, No. 161 at p. 2; Better Homes, No. 168 at p. 1; OMHA, No. 166 at p. 2; MHI, No. 182 at p. 2; ACEEE, No. 178 at p. 3; Next Step, No. 174 at p. 2; MMHA, No. 170 at p. 2; Clayton Homes, No. 185 at p. 1; Palm Harbor Homes, No. 193 at p. 3; MHISC, No. 191 at p. 2; AMHA, No. 173 at p. 2; Skyline Corporation, No. 165 at p. 2; MHI, No. 182 at p. 8; Form Letters, No. 182 at p. 1, Commodore Corporation, No. 195 at p. 2)

NEEA suggested that DOE establish a collaborative method with HUD to provide compliance oversight with the DOE standards. As suggested by NEEA, HUD could continue to use the existing Design Approval Primary Inspection Agencies (DAPIA) and Inspection Primary Inspection Agencies (IPIA) system, with DOE serving as a third-party review and technical support through periodic energy code compliance studies. (NEEA, No. 190 at p. 2)

ACEEE and South Mountain stated that in order to have effective compliance, it is important that DOE provide training and tools to assist manufacturers in compliance and to monitor effectiveness of implementation, particularly during the initial implementation period. (ACEEE, No. 178 at p. 4; South Mountain, No. 151 at p. 1) One particular technical tool that was suggested by SBRA and Palm Harbor Homes was a single software package that provides a platform for overall compliance. This software could check for HUD and DOE Code compliance, conduct loads analysis (Manual J), equipment sizing (Manual S), generate an Energy Rating Index, and check for ENERGY STAR® compliance. (SBRA, No. 163 at p. 2; Palm Harbor Homes, No. 193 at p. 3) Lastly, ACEEE commented that the residential compliance software used by DOE, REScheck, also be adapted to verify these new requirements. (ACEEE, No. 178 at p. 4)

DOE also received comments regarding specific aspects of compliance and enforcement. Earthjustice commented that DOE should move quickly to propose and finalize provisions related to compliance and enforcement, but that these specific provisions should not delay finalizing the overall rule. (Earthjustice, No. 169 at p. 2)

WSU Energy Program commented that insulation installations and air leakage compliance must be clear for IPIA- and DAPIA-approved quality assurance, suggesting a compliance approach that relies on existing HUD mechanisms. (WSU Energy Program, Public Meeting Transcript, No. 148 at pp. 42, 57)

ACEEE commented that some degree of energy-related information should be provided to purchasers, renters, and owners. To make this possible, ACEEE urged DOE to require MH manufacturers to use effective labeling and sales information that would easily convey the effects of the energy conservation standards to consumers, but without undue burden on manufacturers. (ACEEE, No. 178 at p. 4)

Modular Lifestyles commented that consumers do not usually buy homes directly from the manufacturer; normally, retailers will purchase the manufactured homes from the manufacturer to then sell to consumers. Modular Lifestyle commented that the manufacturer should be held accountable, upon the purchase of the manufactured home by the retailer, that the home meets the consumer's local energy conservation standards, as the manufacturer and consumer may be located in different DOE climate zones. (Modular Lifestyle, No. 141 at p. 2)

NCJC suggested both that compliance and enforcement standards be included in the energy conservation standard, and that a provision be added that would allow homeowners to sue manufacturers for failure to construct homes in accordance with these energy conservation standards. (NCJC, No. 184 at p. 2) GWU suggested DOE consider retrospectively reviewing its rule after implementation to assess any potential overlap or conflicts with the existing HUD Code. (GWU, No. 175 at p. 11)

DOE appreciates the comments received on potential options for a CCE system. DOE will consider the comments related to CCE received in this rulemaking and will consult with HUD in any future action on CCE.

### *E. Energy Conservation Standards Requirements*

This section discusses in detail the energy conservation standards proposed in this SNOPR, in particular as compared to the energy conservation standards as proposed in the June 2016 NOPR. In response to the 2021 IECC, additional analyses conducted by DOE, and comments received to the June 2016 NOPR, including those regarding potential adverse impacts on price-sensitive low-income purchasers of manufactured homes, DOE is updating the proposed energy conservation standards as presented in the June 2016 NOPR.

The following paragraphs discuss the tiered and untiered standard proposed for manufactured homes based on the 2021 IECC. As discussed previously, the proposed Tier 1 standard would include manufactured homes with a manufacturer's retail list price of $55,000 or less (in real 2019$) and would be subject to a less stringent set of standards, while providing cost-effective energy bill savings and positive cash flow within the first year of occupancy.

DOE is continuing to propose that standards would be codified in a new part of the CFR under 10 CFR part 460 subparts A, B, and C. Subpart A, as proposed, provides the scope of the standards, definitions of key terms, and other commercial standards that are incorporated by reference into this part. The subpart also would establish a compliance date of one year following the publication of the final rule.

As proposed, subpart B would include energy conservation standards requirements associated with the building thermal envelope of a manufactured home according to the climate zone in which the home is located. DOE bases its proposed building thermal envelope energy conservation standards on the three HUD zones. Under the proposal, manufacturers may choose between two pathways to comply, with each one ensuring an appropriate level of thermal transmittance through the building thermal envelope. The first pathway relies on prescriptive requirements for components of the building thermal envelope. The second pathway relies on performance requirements, under which a manufactured home is required to achieve a maximum $U_o$ in addition to fenestration *U*-factor and SHGC requirements. Manufactured homes would be required to comply with one of these two pathways. Subpart B would also establish prescriptive requirements for insulation and sealing the building thermal envelope to limit air leakage.

Proposed subpart C includes requirements related to duct leakage, HVAC thermostats and controls, service water heating, mechanical ventilation fan efficacy, and equipment sizing.

#### 1. Subpart A: General

DOE received several comments regarding the rulemaking in general, both in favor of and opposed. A number of commenters stated that they support the overall standards proposed by DOE in the June 2016 NOPR. (ACEEE, Public Meeting Transcript, No. 148 at p. 17; NEEA, No. 190 at p. 1; South Mountain, No. 151 at p. 1; RECA, No. 188 at p. 1) ACEEE and RECA also commented on the many benefits of the requirements as proposed in the June 2016 NOPR, especially on the energy savings for the owners of manufactured homes. (ACEEE, Public Meeting Transcript, No. 148 at p. 17; RECA, No. 188 at p. 1) NEEA commented that it supports the improved overall building thermal envelope efficiency, citing both increased insulation and lower fenestration *U*-values. (NEEA, No. 190 at p. 1) Natural Resource Defense Council (NRDC) stated that DOE's standards as proposed in the June 2016 NOPR have opportunities for very high return on investments and are justified on an overall economic perspective. (NRDC, Public Meeting Transcript, No. 148 at p. 16) NJCJ and WSU Energy Program commented that the improved standards will help address not only high energy bills, but also help reduce physical degradation to the house, which is an issue that plagues many manufactured home homeowners. (NCJC, No. 184 at p. 2; WSU Energy Program, Public Meeting Transcript, No. 148 at p. 106) While these commenters expressed general support for the rulemaking, some provided specific criticisms, which are discussed in more detail throughout this SNOPR.

Earthjustice and NCJC urged DOE to implement the proposed rule as soon as possible, as it has gone through a prolonged development process and general consensus was reached in late 2014. These commenters stated that additional time taken to implement this rule deprives new manufactured home homeowners the benefits of greater energy conservation standards. (Earthjustice, No. 169 at p. 1; NCJC, No. 184 at p. 1) NEEA stated that DOE provided more than adequate time for stakeholders to participate and provide comment, and that the rule should be finalized. (NEEA, No. 190 at p. 1)

DOE appreciates the comments supporting the proposed energy conservation standards and the projected benefits. DOE notes that the currently proposed standards were developed with consideration of recommendations received through an in-depth consensus process, recommendations received from a working group, consultations with HUD, and comments received during rulemaking. As noted, EISA requires DOE to base the energy conservation standards on the most recent version of the IECC (42 U.S.C. 17071(b)(1)), and that following the June 2016 NOPR, the 2018 and 2021 editions of the IECC were published. In response, DOE considered the changes to the IECC from the version used in the June 2016 SNOPR (2015 IECC), as well as cost-effectiveness considerations, in developing the energy conservation standards proposed in this SNOPR.

DOE also received comments urging caution in establishing a final rule. SBRA and NCJC stated that while they

believe that sections of the document can be improved, the overall rule should be adopted. (SBRA, Public Meeting Transcript, No. 148 at p. 148; NCJC, No. 184 at p. 1) Cavco stated that this rulemaking should be thoroughly vetted and reviewed because any errors in the calculation of cost-effectiveness could have a significant negative impact on consumers and the manufactured housing industry. (Cavco, Public Meeting Transcript, No. 148 at p. 151) MHI stated that given the magnitude of issues to be addressed (a general reference to all comments raised by MHI), DOE should consider publishing another draft rule for comment before moving to a final rule. (MHI, No. 182 at p. 8)

Several commenters were specifically concerned with increased consumer cost, which is addressed in section IV.A.1.g, and issues regarding compliance, which is addressed in section III.D. (OMHA, No. 166 at p. 1; MHISC, No. 191 at p. 1; WVHI, No. 156 at p. 1; MHIM, No. 155 at p. 1; NMMHA, No. 157 at p. 1; MHIAZ, No. 161 at p. 1; PMHA, No. 164 at p. 1; Skyline Corporation, No. 165 at p. 1; Commodore Corporation, No. 195 at p. 1)

In response to comments received related to potential adverse impacts on price-sensitive, low-income purchasers, and in light of the consultation with HUD, DOE has updated its analyses specifically to evaluate the potential burden of incremental costs from energy conservation standards on low-income purchasers. To allow stakeholders to comment on the updated proposal contained in this SNOPR, DOE notes that it is proposing updated requirements based on further analyses and is requesting additional comments before establishing a final rule.

a. Proposed § 460.1 Scope

Section 431 of EISA directs DOE to establish energy conservation standards for manufactured housing. (42 U.S.C. 17071(a)(1)) In this SNOPR, DOE proposes that § 460.1 (1) restate the statutory requirement and introduce the scope of the requirements, and (2) require manufactured homes that are manufactured on or after one year following publication of the final rule to comply with the requirements established, consistent with the June 2016 NOPR. 81 FR 39756, 39766 DOE stated that a 1-year notice period is a common industry practice for changes to building codes, and would allow manufacturers to transition their designs, materials, and factory processes to comply with the finalized DOE energy conservation standards. *Id.*

In response to the June 2016 NOPR, ACEEE and South Mountain supported the 1-year period before the rule becomes effective, stating a 1-year period appropriately balances the urgency of implementing the energy conservation standards and the work required of manufacturers to implement changes. (ACEEE, No. 178 at p. 1; South Mountain, No. 151 at p. 1) RECA recommended an implementation timeline of no longer than one year, as outlined in the June 2016 SNOPR. (RECA, No. 188 at p. 2) RECA, Next Step Network, and Modular Lifestyles commented that many manufacturers produce higher efficiency homes that already meet the energy conservation standards, indicating that the path to compliance was known and well established. (RECA, No. 188 at p. 2; Next Step, No. 174 at p. 1; Modular Lifestyles, No. 141 at p. 2) AGA and APGA suggested that the lead time for compliance instead be 5 years, as this would both allow more time for the market to adjust as well as give more time to educate consumers. (AGA and APGA, No. 172 at p. 1) In addition, Advocacy recommended that DOE adopt delayed compliance schedules for small manufacturers, as this would allow them to manage their limited resources. (Advocacy, No. 177 at p. 4)

As noted in comments previously, the industry has experience with the means to comply with the proposed requirements. DOE notes that section 413 requires DOE to update the manufactured home standards within one year following an update to the IECC. (42 U.S.C. 17071(b)(3)(B)) A one-year lead time for compliance would allow DOE to evaluate industry compliance with the proposed standards, if made final, prior to consideration of updates to the IECC in 2024, as required by the statute. The one-year lead time would also minimize the lag time between updates to the IECC and any potential updates to the DOE standards, ensuring that manufactured home purchasers are receiving energy savings based on the most recent model energy codes.

DOE recognizes that compliance with the DOE energy conservation standards may require manufacturers to update designs and certifications required under the HUD Code. However, EISA requires DOE to base the energy conservation standards for manufactured homes on the latest edition of the IECC, with considerations made for cost-effectiveness. As discussed in detail in section I.A, while manufacturers may incur costs to update designs to meet the proposed standards, if finalized, these costs appear outweighed by the benefits gained in energy savings by manufactured home purchasers as a result of the standards.

DOE requests comment on whether a one-year lead time would be sufficient given potential constraints that compliance with the DOE standards may initially place on the HUD certification process, and whether a longer lead time (*e.g.,* a three-year lead time) or some other alternative lead-time for this first set of standards (*e.g.,* phased-in over three years, with one-year lead-times thereafter) should be provided.

b. Proposed § 460.2 Definitions

In this SNOPR, DOE proposes to maintain certain definitions proposed in the June 2016 NOPR, update other definitions from the June 2016 NOPR based on comments received, and add/update certain definitions based on the later IECC version published since the June 2016 NOPR (the 2018 IECC and the 2021 IECC). As such, DOE proposes the definitions for the following terms proposed in the June 2016 NOPR remain the same for § 460.2: ''automatic,'' ''ceiling,'' ''climate zone,'' ''continuous air barrier,'' ''door,'' ''duct,'' ''duct system,'' ''fenestration,'' ''floor,'' ''glazed or glazing,'' ''insulation,'' ''manufactured home,'' ''manufacturer,'' ''manual,'' ''*R*-value (thermal resistance),'' ''rough opening,'' ''service hot water,'' ''solar heat gain coefficient (SHGC),'' ''state,'' ''thermostat,'' ''*U*-factor (thermal transmittance),'' ''$U_o$ (overall thermal transmittance),'' ''ventilation,'' ''vertical fenestration,'' ''wall,'' ''whole-house mechanical ventilation system,'' ''window,'' and ''zone.''

Furthermore, DOE proposes definitions in the SNOPR for the following terms that are either (1) updates from the June 2016 NOPR, (2) new proposals based on the 2018 and 2021 IECC, or (3) other clarifications needed, as discussed later in this section: ''access (to)''; ''air barrier''; ''building thermal envelope''; ''conditioned space''; ''dropped ceiling''; ''dropped soffit''; ''eave''; ''equipment''; ''exterior ceiling''; ''exterior floor''; ''exterior wall''; ''heated water circulation system''; ''2021 IECC''; ''opaque door''; ''skylight''; ''skylight well'';

The following paragraphs summarize the comments received to the June 2016 NOPR and DOE's analysis of the 2018 and 2021 IECC updates to the definitions.

COBA requested that a definition of the term ''affordable housing'' be added. COBA suggested the following:

''Housing is affordable when individuals or households earning less than half the Area Median Income or AMI can afford to rent a conventional apartment or buy a home in their local housing market.'' [23] (COBA, No. 158 at p. 3) Regarding affordability, WSU Energy Program stated that ''affordability'' should be defined as affordable to purchase at the upfront cost, as suggested by COBA, but also affordable to maintain and operate. (WSU Energy Program, No. 148 at pp. 20, 85) Impact on purchase price is a particular consideration in the development of the energy conservation standards for manufactured housing, and DOE requested comments on the potential impact of standards on affordability/purchase price. 81 FR 39756, 39765, 39784. However, affordability is not an element of the proposed regulatory text in this SNOPR and ''affordability'' as a defined term is not needed to support the energy conservation standard regulatory text (at 10 CFR part 460). As such DOE is not proposing a definition of ''affordability''.

ACC FSC requested that DOE define ''continuous insulation.'' (ACC FSC, No. 186 at p. 1) DOE determined in the June 2016 NOPR that a definition for ''continuous insulation'' was not necessary, as it was deemed not relevant to the proposed energy conservation requirements. Because the regulatory text proposed does not use the term ''continuous insulation,'' DOE is not proposing a definition for this term.

NEEA commented that improved clarity on what is considered interior conditioned space is needed. NEEA stated that the space under the floor but above insulation should not be considered conditioned space. (NEEA, No. 190 at p. 2) DOE recognizes that there was some confusion regarding the definition of ''conditioned space'' proposed in the June 2016 NOPR. DOE intended to use the 2015 IECC definition for the term ''conditioned space,'' but an error led to an incorrect definition being listed in § 460.2 of the proposed regulatory text. For this SNOPR, DOE proposes that the definition of conditioned space match the 2021 IECC definition, which is the same as the 2015 IECC definition for conditioned space. Using this proposed definition, the space under the floor but above the insulation is considered conditioned space. As DOE is proposing the term as defined in the IECC, the term is appropriately understood by industry. Therefore, DOE proposes to define ''conditioned space'' as an area, room, or space that is enclosed within the building thermal envelope and that is directly or indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate through openings with conditioned space, where they are separated from conditioned spaces by uninsulated walls, floors or ceilings, or where they contain uninsulated ducts, piping, or other sources of heating or cooling.

NEEA recommended that ''skylight wells'' be defined as exterior walls, to clearly indicate that they require insulation to at least exterior wall insulation levels. (NEEA, No. 190 at p. 3) While ''skylight'' is defined in the 2021 IECC, ''skylight well'' is not defined. As suggested by NEEA, a ''skylight well'' would extend from the interior finished surface of the exterior ceiling to the exterior surface of the roof. For some homes, the upper part of this well may exist above the exterior ceiling insulation. This upper part of the well would provide an uninsulated path from the interior to the exterior of the home if the skylight well were not insulated. Per the proposed definition of exterior wall, ''skylight wells'' would be considered exterior walls. DOE agrees with NEEA's suggestion to define the term ''skylight well,'' which DOE proposes to define as encompassing the walls underneath a skylight that extend from the interior finished surface of the exterior ceiling to the exterior surface of the location to which the skylight is attached.

DOE also proposes to specify that skylight wells are exterior walls by updating the definition of ''exterior wall'' to include skylight wells. DOE proposes to define ''exterior wall'' as a wall, including a skylight well, that separates conditioned space from unconditioned space.

HUD's allowance of ''alternative construction'' of manufactured homes permits manufacturers to utilize new designs or techniques. 24 CFR 3282.14. One such home design can be a multistory manufactured home. In this SNOPR, DOE proposes that the ceiling, wall, and floor building thermal requirements for these energy conservation standards are only for the exterior ceiling, wall, and floor that separate conditioned space from unconditioned space, not for any internal ceilings that can be found in a multistory manufactured home, or for interior walls. Therefore, DOE proposes adding definitions for the term ''exterior ceiling'' as a ceiling that separates conditioned space from unconditioned space and ''exterior floor'' as a floor that separates conditioned space from unconditioned space.

DOE also proposes to update the following definitions proposed in the June 2016 NOPR that included ''ceiling'' and ''floor'' to include the use of ''exterior ceiling'' and ''exterior floor,'' as appropriate: ''building thermal envelope,'' ''dropped ceiling,'' ''dropped soffit,'' ''eave,'' and ''rough opening.''

DOE also reviewed several relevant definitions updated since the publication of the 2015 IECC (in the 2018 IECC and the 2021 IECC). For the 2018 IECC, the updates included the following terms: ''air barrier'' and ''building thermal envelope.'' These same updates were carried over to the 2021 IECC. DOE reviewed these updates and finds them to be clarifications rather than substantive changes. Specifically, the 2018 (and 2021) IECC definition for ''air barrier'' clarified that the materials should be joined together in a continuous manner to restrict or prevent passage of air through the building thermal envelope; the ''continuous manner'' element was not part of the same definition in the 2015 IECC. The addition of this term means that the material should be joined together without any thermal bridges, other than fasteners and service openings, so that any passage of air through the building thermal envelope is prevented. DOE notes that the term ''continuous'' is one generally used by and understood within industry and is consistently used in the 2021 IECC (without being defined).

The 2018 (and 2021) IECC definition for ''building thermal envelope'' specified that it should be building element assemblies as opposed to just building elements. DOE has tentatively determined this update to be non-substantive because it clarifies the original intent of the definition to include all components that separate conditioned from unconditioned space. In addition, the 2018 IECC also added a new definition for ''opaque door.'' The term opaque door is included in the definition for ''vertical fenestration'' but previously had not been defined. The 2018 IECC defines an opaque door as a door that is not less than 50 percent opaque in surface area.

For the 2021 IECC, the relevant updates included the following terms: ''accessible,'' which was replaced by ''access (to),'' and ''skylights.'' DOE had only previously proposed a definition for ''accessible'' because the 2015 IECC defined the term and included the term in the residential provisions, which DOE had incorporated into the regulatory text. However, the 2021 IECC replaces ''accessible'' with ''access (to)''

[23] Allen, G. and Savage, B. The First 20 Years! 2013. PMN Publishing; Franklin, IN.

and no longer includes the term ''accessible'' in the residential provisions of the IECC. In response to the June 2016 NOPR, NEEA commented that a clearer definition of the word ''access'' was required.[24] (NEEA, 190 at p. 2). As the definition of the word ''access'' is now found in the 2021 IECC, DOE is proposing to include a definition for ''access''. Further, to prevent confusion, DOE proposes to revise the regulatory text to incorporate the use of the word ''access'' instead of ''accessible,'' similar to the updates in the 2021 IECC. Therefore, DOE proposes to define the term ''access (to)'' as ''that which enables a device, appliance or equipment to be reached by ready access or by a means that first requires the removal or movement of a panel or similar obstruction.''

In addition, the 2021 IECC clarifies that skylights include ''unit skylights, tubular daylighting devices, and glazing materials in solariums, sunrooms, roofs and sloped walls.'' DOE understand these updates to be clarifications rather than a substantive change and does not alter the meaning of the original definition. Therefore, DOE proposes to include this clarification in the proposed skylight definition. Accordingly, DOE proposes to include the updated definitions for ''air barrier,'' ''building thermal envelope'' and ''skylight'' and the new definition for ''opaque door'' and ''access (to)'' in this SNOPR.

In review of the proposed regulatory text from the June 2016 NOPR, DOE also recognized that the term ''Circulating hot water system'' is defined, but the term ''heated water circulation system'' is used in the substantive requirements of the June 2016 NOPR. In this SNOPR, DOE proposes to change this defined term to reflect what is used in the substantive provisions of the regulations. Additionally, DOE defined the term ''service hot water'' in the June 2016 SNOPR, but the proposed substantive requirements also used the term ''service water heating.'' The IECC uses both terms. For consistency DOE proposes to define and use the term ''service hot water'' throughout the regulations.

DOE also recognized that the June 2016 NOPR definition for ''equipment'' included the term ''appliances''. However, the MH working group generally did not recommend provisions addressing appliances. Furthermore, this SNOPR is not proposing requirements for appliances that are regulated pursuant to the statutory scheme in EPCA. Therefore, DOE proposes to remove ''appliances'' from the definition of ''equipment.''

DOE also recognized that the term ''infiltration'' was defined in the proposed regulations in the June 2016 NOPR but was not otherwise used. As the term is not used in the regulatory text, DOE proposes to not include a definition for ''infiltration'' in this SNOPR.

DOE requests comment on its understanding of the definitional changes in the 2018 IECC and the 2021 IECC. DOE also requests comments on its changes to the proposed definitions as compared to those proposed in the June 2016 NOPR.

c. Proposed § 460.3 Materials Incorporated by Reference

In this SNOPR, DOE is not proposing to incorporate the 2021 IECC by reference. The 2021 IECC serves as the basis for the regulations proposed in this document, with the proposed requirements addressing technical issues specific to manufactured homes, relying on the HUD zones, and addressing issues related to health and safety, as well as the need to preserve the affordability of manufactured homes.

Further, DOE continues to propose to incorporate by reference Air Conditioning Contractors of America (''ACCA'') Manual J; ACCA Manual S; and ''Overall *U*-Values and Heating/Cooling Loads—Manufactured Homes'' by Conner and Taylor (the Battelle Method). DOE proposes that ACCA Manuals J and S would be incorporated by reference in § 460.205 of the regulatory text and would relate to the selection and sizing of heating and cooling equipment. In addition, the Battelle Method is an industry standard methodology for calculating the overall thermal transmittance ($U_o$) of a manufactured home and is also currently referenced in the HUD Code for calculation of overall thermal transmittance. DOE proposes to use the Battelle method to determine the same ($U_o$).

In response to the June 2016 NOPR, ACCA commented in favor of the references to Manual J and Manual S. (ACCA, No. 159 at p. 2) DOE also received comments regarding the 2015 IECC (which was the basis of the June 2016 NOPR requirements). The ICC commented that it is concerned with the manner that DOE proposed to use and modify the IECC, which is copyrighted, specifically that DOE did not incorporate by reference the 2015 IECC. Referencing Circular OMB Circular A–119, ''Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities, Revised,'' ICC stated that all ''Federal agencies must use voluntary consensus standards in lieu of government-unique standards in their procurement and regulatory activities,'' and that DOE must report the reasons for its use of government-unique standards in lieu of voluntary consensus standards. The ICC also commented that section 5.g of the OMB Circular A–119 directs agencies ''to observe and protect the rights of the copyright holder.'' (ICC, No. 160 at p. 3) ICC commented that in order to meet minimum requirements for OMB–A119, DOE must ''(a) expressly acknowledge that the IECC is a copyright protected document, published and owned by ICC; (b) explicitly state that any reproduction or copying of the standard (other than for personal, non-commercial purposes) requires express written permission or license from ICC; and (c) state that copies of the IECC are available for purchase from ICC at its website, *www.iccsafe.org.*'' (ICC, No. 160 at p. 4) ACCA also commented that the incorporation of the 2015 IECC language, either directly or with slight modification, should require DOE to properly acknowledge the ICC and its work, as the 2015 IECC is copyright protected. (ACCA, No. 159 at p. 2)

Subject to copyright law, DOE acknowledges that the IECC is a copyright protected document, published and owned by the ICC, and that reproduction or copying of the IECC requires written permission or license from the ICC. As noted above, copies of the IECC are available for purchase at *www.iccsafe.org.* They may also be viewed for free on ICC's public access website at: *https://codes.iccsafe.org/public/collections/I-Codes.* As discussed previously, DOE and the MH working group evaluated the 2015 IECC, and DOE subsequently evaluated the 2018 and the 2021 IECC. The MH working group recommendations and the June 2016 NOPR were based on the 2015 IECC, but as explained throughout this document, modifications are necessary to address technical issues that are specific to manufactured housing, as opposed to site-built housing, which is the focus of the IECC. As such, the SNOPR's proposals (1) are based directly on certain IECC sections, (2) are based on other sections of the IECC with modification, and (3) do not include certain other sections as they were either not pertinent to manufactured

[24] In the June 2016 NOPR, DOE proposed that access hatches, panels, and doors must provide *access to* all equipment that prevents damaging or compressing of the insulation.

housing or not needed to establish energy conservation standards.

DOE requests comment on incorporating by reference ACCA Manual J, ACCA Manual S, and ''Overall *U*-Values and Heating/Cooling Loads—Manufactured Homes'' by Conner and Taylor.

d. Proposed § 460.4 Energy Conservation Standards

Proposed § 460.4 would specify that manufactured homes would be required to comply with the proposed building thermal envelope in subpart B and the equipment and controls requirements in subpart C, as applicable. The proposed requirements of subparts B and C are discussed in the following paragraphs. As discussed, DOE is proposing a tiered proposal with two tiers of energy conservation standards based on the manufacturer's retail list price of a manufactured home. Under the tiered proposal proposed § 460.4 would specify the requirements applicable to the two tiers.[25]

2. Subpart B: Building Thermal Envelope

The proposed requirements in subpart B relate to climate zones, the building thermal envelope, installation of insulation and building thermal envelope leakage for manufactured homes. The following sections provide further details, a discussion of comments on the June 2016 NOPR relevant to subpart B and responses to any such comments. As discussed above, the tiered standards approach is DOE's primary proposal in this document *i.e.* manufactured homes with manufactured retail list prices of $55,000 or less (Tier 1 manufactured homes) would be subject to different building thermal envelope requirements than all other manufactured homes (Tier 2 manufactured homes). The requirements are discussed in the following sections.

a. Proposed § 460.101 Climate Zones

Pursuant to EISA, DOE may base its energy conservation standards on the climate zones established by HUD rather than on the climate zones contained in the IECC. (42 U.S.C. 17071(b)(2)(B)) The potential for climactic differences to affect energy consumption supports an approach in which energy conservation standards account for geographic differences in climate. In this SNOPR, DOE proposes to align with the HUD climate zones.

As indicated in Figure III.1, the HUD Code divides the United States into three distinct climate zones for the purpose of setting its building thermal envelope requirements, the boundaries of which are separated along state lines. By contrast, as indicated in Figure III.2, section R301 of the 2021 IECC divides the country into nine climate zones, the boundaries of which are separated along county lines. The 2021 IECC also provides requirements for three possible variants (dry, moist, and marine) within certain climate zones, as indicated in Figure III.2. The HUD Code zones were developed to be sensitive to the manner in which the manufactured housing industry constructs and places manufactured homes into the market. The IECC climate zones are separated along county lines to reflect a more granular overview of climate distinctions within the United States, and to facilitate state and local enforcement of the IECC for residential and commercial buildings, including site-built and modular construction.

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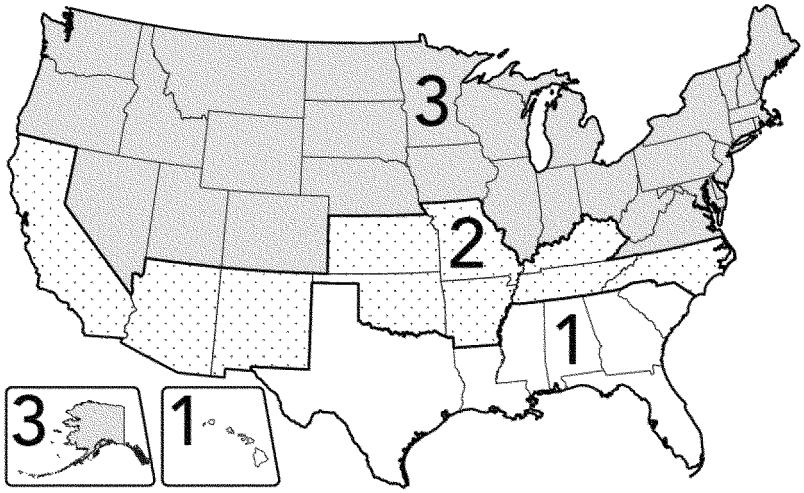


**Figure III.1 $U_o$ Zones in the HUD Code**

[25] In the proposed regulatory text provided at the end of this document, bracketed language is specific to the tiered proposal.

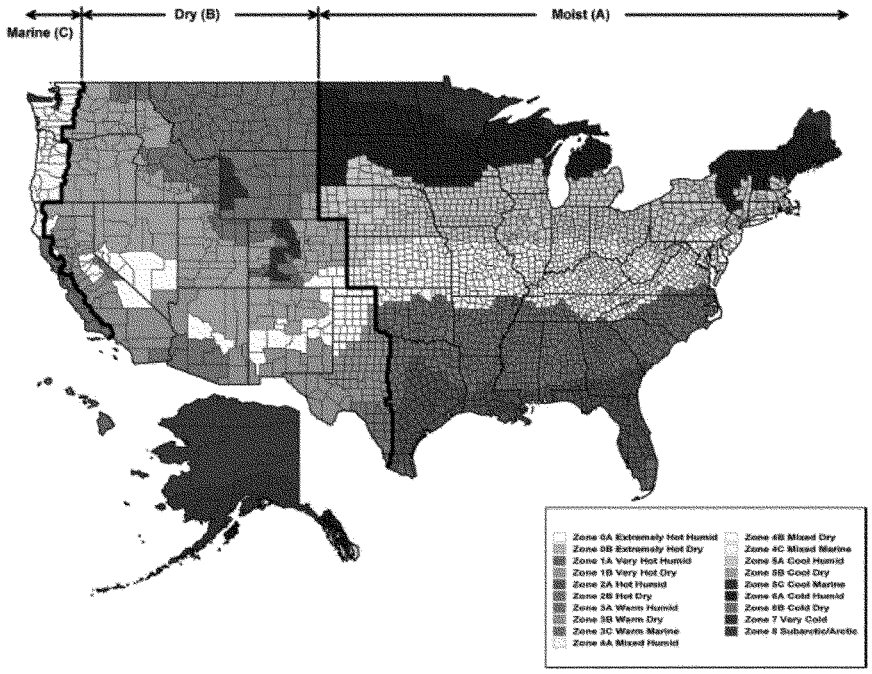


**Figure III.2 Climate Zones in the 2021 IECC**

In the June 2016 NOPR, proposed § 460.101 provided for four climate zones, as illustrated in Figure III.3. This was based on the MH working group recommendation that DOE establish four climate zones that placed cities with the same set of most-cost-effective building thermal envelope requirements in the same climate zone. DOE's proposed climate zones bifurcated Texas, Louisiana, Alabama, Mississippi, Georgia, and Arizona.

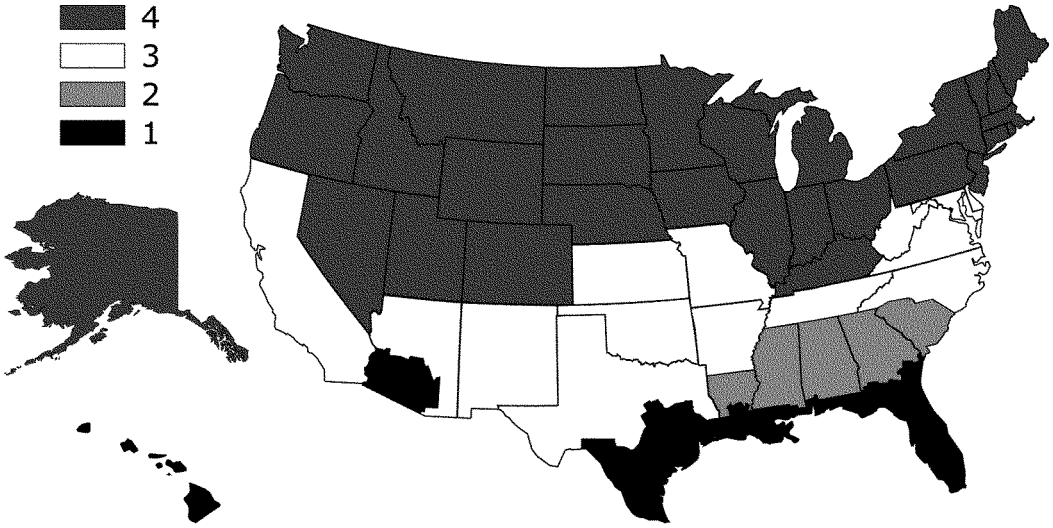


**Figure III.3 June 2016 NOPR-Proposed Climate Zones**

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DOE received several comments regarding climate zones. Modular Lifestyles recommended alternate climate zones. It stated that the local building ZIP code should be used to determine the building climate zone for the placement of a manufactured home. As an example, it referenced the California Energy Commission's climate zones for California, which has 16 building climate zones based on ZIP codes. (Modular Lifestyles, No. 141 at p. 1) In essence, Modular Lifestyles advocated for a finer resolution in climate zones, potentially with even more climate zones than listed in the IECC.

In the June 2016 NOPR, DOE proposed four climate zones based on the recommendation and analysis completed by the MH working group (using the 2015 IECC), which placed cities with the same set of most-cost-effective building thermal envelope requirements in the same climate zone. As noted above, in this document DOE is proposing in this SNOPR a set of energy efficiency requirements applicable to Tier 1 manufactured

homes to provide energy savings at an incremental purchase price of approximately $750 and Tier 2 manufactured homes. The June 2016 NOPR climate zone analysis did not consider this tiered proposal.

In this SNOPR, DOE proposes to incorporate the HUD zones instead of the June 2016 NOPR-proposed climate zones, as explicitly permitted under EISA. (42 U.S.C. 17071(b)(2)(B)) As noted, the HUD zones were developed with specific consideration of the manner in which the manufactured housing industry constructs and places manufactured homes into the market. The HUD zone boundaries are separated along state lines, whereas the June 2016 NOPR-proposed climate zones bifurcated certain states. Aligning the climate zones between the DOE requirements and the HUD Code would reduce the complexities faced by manufacturers in coordinating compliance between the two sets of requirements. Additionally, it would reduce the potential for confusion of manufactured home purchasers, by allowing them to rely on a single map to determine whether a manufactured home would be appropriate for a given location, as opposed to requiring them to consult one map under the HUD Code and a different map under the DOE requirements.

Modular Lifestyle's suggestion to use local building zone ZIP codes to determine climate zones would extend the subdivision of states and be overly burdensome for manufacturers. Although its suggested climate zones could more accurately account for U.S. climatic conditions that affect energy use, the potential benefit of this accounting would be offset by the impracticality to the manufactured housing industry of developing homes per building ZIP code, with multiple zones existing within the same state, where the eventual destination of the home is not always known when the home is manufactured.

DOE also received comments regarding the proposed climate zone map (Figure 460.101), Table 460.101–1, and Table 460.101–2 from the June 2016 NOPR that provided a list of the U.S. states located in each climate zone. Several commenters stated that there was inconsistency between where Kentucky was located in Figure 460.101, and where it was located in Table 460.101–1. (Cavco, No. 167 at p. 1; Earthjustice, No. 169 at p. 2; MHI, No. 182 at p. 1; Clayton Homes, No. 185, at p. 2; PMHA, No. 164 at p. 3) Cavco, Clayton Homes, and MHI recommended that Kentucky be moved to climate zone 3 in the map figure. Several commenters also stated that California was missing in Table 460.101–1 and Table 460.101–2, and therefore the tables needed to be updated. (Clayton Homes, No. 185 at p. 2; MHCC, No. 162 at p. 1; Earthjustice, No. 169 at p. 2; Skyline, No. 165 at p. 2) As already discussed, for this SNOPR, DOE proposes to align with the HUD zones as opposed to the June 2016 NOPR-proposed climate zones. Accordingly, comments received regarding issues with the June 2016 proposed climate zone map are no longer applicable to this SNOPR.

DOE requests comment on basing the climate zones on the three HUD zones instead of the June 2016 NOPR-proposed four climate zones, or other configuration of climate zones. DOE further requests input on whether energy efficiency requirements should be based on smaller geographic areas than provided with the 3 or 4 zone model.

b. Proposed § 460.102 Building Thermal Envelope Requirements

In this SNOPR, DOE's primary proposal is the tiered proposal and the alternate proposal is the untiered proposal. Both proposals are based on the HUD zones. For the tiered proposal, Tier 1 would incorporate building thermal envelope measures based on certain thermal envelope components subject to the 2021 IECC but would limit the incremental purchase price increase to an average of approximately $750. For Tier 2, DOE proposes building thermal envelope measures based on those proposed in the June 2016 NOPR, updated to reflect the HUD zones and the 2021 IECC requirements. The alternate untiered proposal requirements would be the same as the Tier 2 requirements.

Consistent with the June 2016 NOPR, DOE proposes to add § 460.102 in the regulatory text to establish requirements related to the building thermal envelope, including the materials within a manufactured home that separate the interior conditioned space from the exterior of the building or interior spaces that are not conditioned space. Further DOE also proposes that § 460.102(a) would provide manufacturers the option of choosing one of two pathways for compliance to ensure that the building thermal envelope would meet more stringent energy conservation levels. These two pathways are known as the prescriptive approach and the performance approach. Consistent with the recommendation of the MH working group and the June 2016 NOPR, DOE proposes to allow manufacturers to choose between these two pathways for compliance, which would result in cost-effective energy savings for homeowners while providing for flexibility within the manufactured housing industry. Term Sheet, No. 107 at pp. 3–4. This approach is consistent with the 2021 IECC, which provides a climate zone-specific prescriptive building thermal envelope component pathway (R402.1.2) and an alternate pathway to compliance, which allows for a home to be constructed using a variety of materials as long as the entire building thermal envelope has a maximum, singular total UA value [26] (R402.1.5).

Further, consistent with the June 2016 NOPR, DOE continues to propose that the prescriptive requirements would establish specific component minimum *R*-value, maximum *U*-factor, and SHGC requirements, providing a straightforward option for construction planning. The prescriptive requirements were proposed under § 460.102(b), with the building thermal envelope requirements proposed under § 460.102(b)(1) The compliance option based on performance requirements, on the other hand, would allow a manufactured home to be constructed using a variety of materials with varying thermal properties so long as the building thermal envelope achieved a required level of overall thermal performance. The performance requirements thus would provide manufacturers with greater flexibility in identifying and implementing cost-effective approaches to building thermal envelope design. The $U_o$ requirements would be determined by applying the proposed prescriptive building thermal envelope requirements to manufactured homes using typical dimensions and construction techniques and then calculating the resulting $U_o$.

In developing the set of Tier 1 energy efficiency measures proposed in this document, DOE considered measures for building elements of manufactured homes based on building components subject to the 2021 IECC (*i.e.,* exterior floor, exterior walls, exterior ceiling, and fenestration). DOE evaluated different combinations of energy efficiency measures and stringencies for exterior floor, wall, ceiling, and windows (fenestration). DOE compared the potential energy savings for each of the different combinations analyzed and preliminarily determined the optimal set of energy efficiency measures that would yield an incremental cost increase of approximately $750. For this analysis, DOE evaluated the same range of energy efficiency measures and costs that were used for the June 2016 NOPR.

[26] UA is the *U*-factor multiplied by area.

In developing the set of Tier 2 energy efficiency measures proposed in this document, DOE first mapped the June 2016 NOPR requirements (based on four climate zones) to HUD zones (based on three climate zones). DOE used the manufactured home national shipment percentages for each of the cities analyzed,[27] and the corresponding HUD zone and the June 2016 NOPR climate zone identifiers for each of the cities. DOE then summed the shipment percentages of the cities with the same June 2016 NOPR proposed climate zones within each of the HUD zones. According to which of the June 2016 NOPR-proposed climate zones showed the maximum shipment weight per HUD zone, DOE incorporated those proposed June 2016 NOPR requirements for that HUD zone.

For proposed climate zone 1, the cities identified were in either the June 2016 NOPR-proposed climate zones 1 or 2; however, the summed shipment weights per the June 2016 NOPR-proposed climate zone did not provide an obvious indicator as to which of the energy efficiency measures to incorporate for proposed climate zone 1. The only difference between the June 2016 NOPR-proposed climate zone 1 and 2 energy efficiency measures was the glazed fenestration requirement. Therefore, in this SNOPR, DOE proposes to use the less stringent glazed fenestration requirement (0.33 vs. 0.25) to accommodate cost-effective measures that were proposed in the June 2016 NOPR for proposed climate zone 2.

Next, DOE considered the updates to the 2021 IECC. In reviewing Section R402.1 of the 2021 IECC, DOE determined the following relevant updates are merited when compared to the 2015 IECC that the MH working group had considered:

- The maximum fenestration *U*-factors were updated from 0.35 to 0.30 for IECC climate zones 3 and 4 (except marine); and from 0.32 to 0.30 for IECC climate zones marine 4, 5 through 8.
- The maximum glazed fenestration SHGC was updated from NR to 0.40 for IECC climate zones 5 and marine 4.
- The minimum ceiling *R*-value was updated from *R*-38 to *R*-49 for IECC climate zones 2 and 3; and from *R*-49 to *R*-60 for IECC climate zones 4 through 8.
- The minimum wall *R*-value was updated from *R*-13 to *R*-13 or *R*-0+10 for IECC climates zones 0 through 2; from *R*-20 or *R*-13+5 to *R*-20 or *R*-13+5ci or *R*-0+15 for IECC climate zones 3; from *R*-20 or *R*-13+5 to *R*-20+5 or *R*-13+10ci or *R*-0+15 for IECC climate zones 4 and 5; and from *R*-20+5 or *R*-13+10ci to *R*-20+5ci or *R*-13+10ci or *R*-0+20 for IECC climate zones 6 through 8.

With regards to the 2021 IECC updates, DOE did not incorporate the minimum ceiling *R*-value updates given the physical space constraints of manufactured homes and because EISA allows DOE to consider the design and factory construction techniques of manufactured homes as compared to site-built and modular homes. (42 U.S.C. 17071(b)(2)). Specifically, manufactured homes typically have a lower overall height compared to site-built homes, which leads to constrained space, and therefore there is less exterior ceiling insulation. DOE did consider all other updates consistent with EISA and the analysis done for the June 2016 NOPR. Accordingly, DOE similarly mapped the 2021 IECC updates to the corresponding proposed climate zone.

Therefore, for the tiered proposal, the Tier 1 prescriptive building thermal envelope requirements are presented in Table III.7 and the Tier 2 prescriptive building thermal envelope requirements are presented in Table III.8. The untiered proposal's building thermal envelope requirements would be the same as the Tier 2 requirements presented in Table III.8.

TABLE III.7—TIER 1 BUILDING THERMAL ENVELOPE PRESCRIPTIVE REQUIREMENTS

| Climate zone | Exterior wall insulation *R*-value | Exterior ceiling insulation *R*-value | Exterior floor insulation *R*-value | Window *U*-factor | Skylight *U*-factor | Door *U*-factor | Glazed fenestration SHGC |
|---|---|---|---|---|---|---|---|
| 1 | 13 | 22 | 22 | 1.08 | 0.75 | 0.40 | 0.7 |
| 2 | 13 | 22 | 19 | 0.5 | 0.55 | 0.40 | 0.6 |
| 3 | 19 | 22 | 22 | 0.35 | 0.55 | 0.40 | Not applicable |

TABLE III.8—TIER 2 (AND UNTIERED) BUILDING THERMAL ENVELOPE PRESCRIPTIVE REQUIREMENTS

| Climate zone | Exterior wall insulation *R*-value | Exterior ceiling insulation *R*-value | Exterior floor insulation *R*-value | Window *U*-factor | Skylight *U*-factor | Door *U*-factor | Glazed fenestration SHGC |
|---|---|---|---|---|---|---|---|
| 1 | 13 | 30 | 13 | 0.32 | 0.75 | 0.40 | 0.33 |
| 2 | 20+5 | 30 | 19 | 0.30 | 0.55 | 0.40 | 0.25 |
| 3 | 20+5 | 38 | 30 | 0.30 | 0.55 | 0.40 | Not applicable |

For the exterior wall insulation, the ''+5'' involves using ''continuous insulation,'' which is insulation that runs continuously over structural members and is free of significant thermal bridging. As a sensitivity analysis, DOE considered the impacts on the LCC savings from requiring less stringent exterior wall insulation (at R-21 instead of R-20+5) to remove the continuous insulation requirement. At R-20+5, the incremental cost relative to the baseline is $2,500, versus $850 for R-21. DOE considered this alternative insulation requirement for zones 2 and 3 to address potential equity impacts in the regional distribution of benefits and costs and to ensure that each metro area analyzed could experience a positive LCC at Tier 2. DOE is considering additional analysis to further explore the impacts of R-21 for Tier 2 homes and the untiered proposal prior to the final rule stage. Further discussion on the sensitivity analysis results is provided in section IV.A.2.

[27] DOE used shipments for 2019 from the annual production and shipment data provided by MHI. See Manufactured Home Shipments by Product Mix, Manufactured Housing Institute (2019).

As discussed, use of the HUD zones (or the climate zones proposed in the June 2016 NOPR) instead of the IECC climate zones does not allow for use of the IECC requirements absent modification. In line with the building thermal envelope requirements and use of the HUD zones, proposed in this document, DOE proposes the following changes to the June 2016 NOPR-proposed regulatory text:

- Update the requirement regarding the use of a combination of *R*-21 batt insulation and *R*-14 blanket insulation in lieu of *R*-30 for the purpose of compliance with the climate zone 3 exterior floor insulation *R*-value requirement. (Under the tiered proposal this would be applicable for Tier 2 only.)
- Update the maximum *U*-factor values as alternatives to the minimum *R*-value requirements. DOE calculated the maximum *U*-factor values by using the Battelle method that was recommended by the MH working group.[28] DOE performed these calculations based on typical wall, ceiling, and floor assemblies used by the manufactured home industry. Table III.9 provides the updated maximum *U*-factor values for Tier 1 manufactured homes under the tiered proposed rule. Table III.10 provides the updated maximum *U*-factor values for Tier 2 manufactured homes (and the untiered manufactured homes) under the tiered proposed rule.

TABLE III.9—*U*-FACTOR ALTERNATIVES TO THE TIER 1 *R*-VALUE REQUIREMENTS

| Climate zone | Exterior ceiling *U*-factor | | Exterior wall *U*-factor | Exterior floor *U*-factor |
|---|---|---|---|---|
| | Single-section | Multi-section | | |
| 1 | 0.061 | 0.057 | 0.094 | 0.049 |
| 2 | 0.061 | 0.057 | 0.094 | 0.056 |
| 3 | 0.061 | 0.057 | 0.068 | 0.049 |

TABLE III.10—*U*-FACTOR ALTERNATIVES TO THE TIER 2 (AND UNTIERED) *R*-VALUE REQUIREMENTS

| Climate zone | Exterior ceiling *U*-factor | | Exterior wall *U*-factor | Exterior floor *U*-factor |
|---|---|---|---|---|
| | Single-section | Multi-section | | |
| 1 | 0.045 | 0.043 | 0.094 | 0.078 |
| 2 | 0.045 | 0.043 | 0.047 | 0.056 |
| 3 | 0.038 | 0.037 | 0.047 | 0.032 |

- Update the building thermal envelope performance requirements. DOE calculated the updated $U_o$ values using the Battelle method for single- and multi-section manufactured homes. Table III.11 provides the updated $U_o$ values for Tier 1 manufactured homes under the tiered proposal. The proposed Tier 1 standards provide energy efficiency standards more stringent than the HUD thermal protection standards required in 24 CFR 3280.506(a). Table III.12 provides the updated $U_o$ values for Tier 2 (and untiered) manufactured homes.

TABLE III.11—TIER 1 BUILDING THERMAL ENVELOPE PERFORMANCE REQUIREMENTS

| Climate zone | Single-section $U_o$ | Multi-section $U_o$ |
|---|---|---|
| 1 | 0.110 | 0.109 |
| 2 | 0.091 | 0.087 |
| 3 | 0.074 | 0.072 |

TABLE III.12—TIER 2 (AND UNTIERED) BUILDING THERMAL ENVELOPE PERFORMANCE REQUIREMENTS

| Climate zone | Single-section $U_o$ | Multi-section $U_o$ |
|---|---|---|
| 1 | 0.086 | 0.082 |
| 2 | 0.062 | 0.063 |
| 3 | 0.053 | 0.052 |

- Update the area-weighted average vertical fenestration *U*-factor requirements to the HUD zones instead. DOE proposes that the area-weighted average vertical fenestration *U*-factor must not exceed 0.48 in climate zone 2 or 0.40 in climate zone 3.
- Update the area-weighted average skylight *U*-factor requirements to reflect use of the HUD zones instead. DOE proposes that the area-weighted average skylight *U*-factor must not exceed 0.75 in climate zone 2 and climate zone 3.

DOE also notes that section R401.2.5 of the 2021 IECC requires that in addition to the prescriptive compliance option, additional energy efficiency requirements must be utilized to achieve further energy savings. Section 408.2 provides five additional efficiency package options to achieve these additional energy savings, which include: (1) Enhanced envelope performance; (2) more efficient HVAC equipment performance; (3) reduced energy use in service water heating; (4) more efficient duct thermal distribution; and (5) improved air sealing and efficient ventilation system.

In developing recommendations the MH working group evaluated the 2015 IECC, which does not include comparable provisions to section R401.2.5 and R408.2 of the 2021 IECC. However, the MH working group generally did not recommend provisions addressing minimum appliance efficiencies. For example, the MH working group reached consensus that R401.5 of 2015 IECC, which provided for tradeoffs between the building thermal envelope and HVAC equipment and other appliances, was not applicable to manufactured homes. (MH working group, No. 107 at p. 22) Consistent with the recommendations of the MH working group, the performance requirements in the proposed energy conservation standards are specific to the building thermal envelope only, and do not incorporate any specifications on HVAC energy efficiency. Accordingly,

[28] ''Overall *U*-Values and Heating/Cooling Loads—Manufactured Homes'' by Conner and Taylor.

DOE did not consider the more efficient HVAC equipment performance and reduced energy use in service water heating options in this SNOPR.

Further, DOE also did not examine the more efficient duct thermal distribution option based on EISA's allowance to consider the design and factory construction techniques of manufactured housing. (42 U.S.C. 17071(b)(2)) DOE understands that the requirements in R408.2 of the 2021 IECC focus primarily on the location of the duct or ductless systems in a home (in terms of duct thermal distribution design) as opposed to improving efficiency of the ducts as already installed and designed. Therefore, the options remaining were those that DOE considered are relevant to manufactured homes and this rulemaking, which include the enhanced envelope performance option and the improved air sealing and efficient ventilation option.

The enhanced envelope performance option in the 2021 IECC requires that the total building thermal envelope UA (the sum of *U*-factor times assembly area) shall be less than or equal to 95 percent of the total UA resulting from multiplying the *U*-factors in Table R402.1.2. (Section R408.2.1 of the 2021 IECC) For this SNOPR, DOE was unable to incorporate this requirement given the proposed building thermal envelope requirements in Table III.8 and the space constraints of manufactured homes.

The improved air sealing and efficient ventilation system option requires that the measured air leakage rate is less than or equal to three air changes per hour (''ACH''), with either heat recovery ventilators (''HRV'') or energy recovery ventilators (''ERV''), installed (with specific requirements on airflow). An HRV recovers heat from the exhaust air and then adds it to the supply air drawn from outside the home. An ERV also recovers heat from the exhaust air, but also transfers some of the moisture from the exhaust air to keep the humidity in the home at a constant level. DOE notes that ERV and HRV fans can be applicable to manufactured housing. However, this option would require an HRV or ERV, which the MH working group or DOE had not considered previously.

Analysis conducted in support of the DOE Building Energy Codes Program (''BECP'') suggests that a primary first cost for HRV could be as high as $1,500.[29] ERVs were not considered in the analysis. Although the BECP analysis concluded that HRVs are cost effective for certain northern climate zones, DOE notes that the analysis conducted is based on a single-family home size conditioned floor area (1,200 to 4,500 ft$^2$ CFA), whereas manufactured homes are typically smaller in size (single section homes are analyzed with 924 ft$^2$ CFA). For this SNOPR, DOE is not proposing either the HRV or ERV option because DOE has not yet determined whether this requirement would be cost-effective in manufactured homes.

DOE requests comment on the Tier 1 energy conservation standards, which would be applicable to manufactured homes with a manufacturer's retail list price of $55,000 or less. DOE also requests comment on the proposed energy conservation standards based on the most recent version of the IECC for the Tier 2 and untiered standards and the consideration of R–21 sensitivity for exterior wall insulation for climate zones 2 and 3.

DOE requests comment on the additional energy efficiency requirements from the 2021 IECC and whether they should apply to manufactured homes, including those that DOE has initially considered as not applicable to manufactured homes. If so, DOE requests comment on how these requirements would apply and the costs and savings associated with these requirements.

The following sections discuss comments DOE received regarding the building thermal envelope requirements proposed in the June 2016 NOPR, and any other corresponding proposed changes to the June 2016 NOPR requirements.

General Comments on the Prescriptive Requirements

DOE received several comments regarding the prescriptive requirements proposed in the June 2016 NOPR. NEEA commented that the prescriptive requirements for exterior walls, floor, ceiling, and fenestration should be based on *U*-factors, not current prescriptive requirements for *R*-value or *U*-factor alternative. NEEA stated that the proposed approach may result in two different thresholds depending on how the engineer chooses to calculate the *U*-factor alternative. (NEEA, No. 190 at p. 2) In response, DOE notes that allowing for both insulation *R*-value and fenestration *U*-factor requirements, in addition to equivalent *U*-factor alternatives to *R*-values, allows for more flexibility for manufacturers to comply with the energy conservation standards. Having both insulation *R*-value and fenestration *U*-factor requirements are also in line with the 2021 IECC requirements. Further, DOE is proposing that manufacturers use the Battelle method for calculating the overall thermal transmittance ($U_o$) of a manufactured home, which is the same as the HUD Code and provides a consistent way to calculate the component *U*-factors to determine $U_o$. Therefore, DOE continues to propose in this SNOPR both *R*-value and *U*-factor options for the prescriptive requirements, and a *U*-factor alternative requirement.

DOE also received several comments regarding the *U*-factor alternatives to *R*-value requirements. NEEA recommended that the *U*-factors used for the standard be recalculated based on framing factors used in the manufactured home industry. For example, in section 7.4.2 of the June 2016 NOPR TSD, the assumed framing factor in walls is 25 percent, which NEEA commented is reasonable for site-built homes, but not for manufactured homes. NEEA commented that typical framing factors in manufactured homes rarely exceed 18 percent because they are single-story structures built in factories with glazing fractions (applicable to windows, skylights, and doors, for example) most commonly less than 12 percent. NEEA also stated that updating the *U*-factors using manufactured home-specific factors would increase the cost-effectiveness of the proposal. (NEEA, No. 190 at p. 2) RECA and ACEEE commented that the proposed *U*-factor values for specified *R*-values were significantly less efficient that the equivalent *U*-factors set by the IECC. (RECA, No. 188 at p. 6 ACEEE, No. 178 at p. 2) WSU Energy Program commented that there might be some issues with the *R*-value and *U*-factor calculations and that the *U*-factor equivalent to *R*-21 that DOE used is much lower than the standard at *R*-21. WSU Energy Program provided the same comment with respect to the exterior floor. (WSU Energy Program, Public Meeting Transcript, No. 148 at p. 42)

Based on the comments received, DOE revisited the calculations performed to determine the *U*-factor alternatives to *R*-value requirements. To perform the calculations, DOE used the Battelle method that was recommended by the MH working group.[30] DOE performed these calculations based on typical wall, ceiling, and floor

[29] Taylor, Zachary T. Residential Heat Recovery Ventilation. United States. *https://doi.org/10.2172/1488935*.

[30] ''Overall *U*-Values and Heating/Cooling Loads—Manufactured Homes'' by Conner and Taylor.

assemblies used by the manufactured home industry.

DOE used a different *R*-value to *U*-factor equivalency conversion than the IECC because the IECC equivalency conversion is primarily based on typical site-built home construction parameters (focus of the 2015 IECC and the 2021 IECC) whereas DOE's focus is typical manufactured home construction parameters. EISA allows for DOE to take the design and factory construction techniques of manufactured homes into consideration for the energy conservation standards. (42 U.S.C. 17071(b)(2)(A)) As such, the *R*-value to *U*-factor equivalency conversion used in this SNOPR is modified from the 2021 IECC conversion approach to reflect manufactured homes rather than site-built homes. When comparing the *U*-factors from the proposal and the *U*-factors from the 2015 IECC and the 2021 IECC, the largest difference is with the exterior ceiling and exterior floor *U*-factors. The manufactured home dimensions that were used in the analysis were those recommended by the MH working group. Manufactured homes typically have a lower overall height compared to site-built homes, which leads to constrained space, and therefore there is less exterior ceiling and exterior floor insulation. See Chapter 7 of the TSD for further details on how the equivalent *U*-factors were determined.

DOE based certain aspects of its rulemaking analysis (*R*-value to *U*-factor conversion, energy use calculations, incremental costs, etc.) on a home built to the typical specifications recommended by the MH working group. These specifications included an assumption of a 25 percent framing fraction, which the MH working group considered typical for manufactured homes. Absent sufficient justification to change the assumptions, which could result in significant changes to fundamental aspects of the recommendations of the MH working group, DOE maintains the assumptions from its analysis in the June 2016 NOPR. As discussed previously, DOE is proposing that manufacturers use the Battelle method for calculating the overall thermal transmittance ($U_o$) of a manufactured home, which allows for the option to use framing fractions based on the construction of the home, in addition to typical framing fractions. Therefore, in practice, if a manufacturer uses a framing fraction specific to the construction of the home, the manufacturer may use more or less insulation relative to the representative home in DOE's model, but the energy use will be the same when using the *U*-factor alternative path to compliance. Therefore, in its analysis, DOE used the recommendations for typical assemblies and the calculation methodology from the MH working group. As previously discussed in this section, DOE has updated the *U*-factor alternatives to match the SNOPR-proposed prescriptive *R*-value building thermal requirements, which reflect use of the HUD zones and the tiered proposal.

DOE also received a comment regarding *U*-factor alternatives for single-section versus multi-section homes. ACEEE stated that basing the *U*-factor alternatives on single-section home construction means the values are less stringent (*i.e.,* can be achieved with lower insulation *R*-values) for multi-section homes. ACEEE urged DOE to use the more stringent multi-section *U*-factors for all homes, or to provide separate values for the two types of homes as is done for the overall *U*-factors ($U_o$) in the performance building thermal envelope requirements. (ACEEE, No. 178 at p. 3)

In response, DOE notes that the objective of the *U*-factor alternative is to create an equivalent *U*-factor requirement when compared to the corresponding *R*-value. Based on this objective, DOE agrees that the *U*-factor alternative should be different for single-section compared to multi-section homes for the external ceiling assembly because the assumed typical construction of the external ceiling differs in the ratio of insulation to framing members. Other assemblies, such as the external wall and floor, are assumed to be the same for single- and multi-section homes, so the *U*-factor alternative for those assemblies would also be the same for both home sizes. For this SNOPR, DOE proposes separate *U*-factor alternatives for the external ceilings of single- and multi-section homes. DOE used the Battelle method to determine the external ceiling *U*-factor for both single- and multi-section homes. More details on the assumptions used for this calculation are provided in chapter 7 of the TSD. See Table III.9 and Table III.10 for the updated proposed external ceiling *U*-factor alternatives.

DOE also received specific comments regarding the prescriptive requirements. NEEA recommended that DOE should provide a list of typical constructions with nominal *R*-value batt insulation configurations that meet the *U*-value targets, as this allows designers to comply with standards without considering all possible framing, door and window configurations. (NEEA, No. 190 at p. 2) The proposed prescriptive requirements already serve this purpose: The prescriptive requirements would allow a manufacturer or designer to simply install certain insulation and fenestration components in the house to achieve compliance with regulations. The *U*-factor alternative and the performance path would provide greater flexibility in selecting insulation and fenestration components if the manufacturer chooses to run the necessary calculations.

ACC FSC stated that there should be a reference to a document that lists *U*-factor assumptions for non-insulation components when calculating *U*-factors. (ACC FSC, No. 186 at p. 1) DOE notes that the Battelle method provides details on typical framing factors, and any component specific rules for *U*-factor calculations. The Battelle method also provides references (including the ASHRAE HOF) and values for non-insulation components. The Battelle method is referenced in proposed section 460.3.

Palm Harbor Homes stated that Table 460.102–2 lists alternative *U*-factors to the fourth decimal, which is inconsistent with the Battelle method incorporated by reference and in which *U*-values are to the third decimal. Palm Harbor Homes recommended rounding the listed *U*-values to three decimal points. (Palm Harbor Homes, No. 193 at p. 2) DOE agrees that the *U*-values should be consistent with the Battelle method, and therefore has rounded the proposed *U*-factor alternatives to three decimal places.

General Comments on the Performance Requirements

DOE received a comment regarding the performance requirements proposed in the June 2016 NOPR. ACC FSC stated that the performance requirements allow for unlimited tradeoffs to the building envelope, as long as the net thermal performance is achieved. It commented that this approach assumes that all components are working together simultaneously, and that the maintenance of HVAC components is sustained. ACC FSC stated, however, that the thermal envelope will last much longer than the service lives of tradeoff components such as HVAC, and the short-term components will be required to be replaced. It suggested that the performance path should have a back-stop to prevent excessive tradeoffs of the thermal envelope. (ACC FSC, No. 186 at p. 1)

The performance requirements in the proposed energy conservation standards are specific to the building thermal envelope, and do not incorporate any specifications on HVAC energy efficiency or maintenance. Therefore, tradeoffs are only allowed within the

building thermal envelope, and not HVAC equipment or other appliances. For the thermal envelope, DOE proposes to limit tradeoffs between insulation and fenestration products via the following constraints, consistent with the MH working group recommendations and the 2021 IECC:

- A maximum area-weighted average vertical fenestration *U*-factor of 0.48 in climate zone 2, or 0.40 for climate zone 3,
- A maximum area-weighted average skylight *U*-factor of 0.75 in climate zones 2 and 3,
- Windows, skylights, and doors containing more than 50 percent glazing by area to satisfy the SHGC requirements under § 460.102(a) on the basis of an area-weighted average.

Prescriptive SHGC Requirements

DOE received several comments on the June 2016 NOPR that suggested that climate zones 1 and 2 should be combined into one climate zone, such that there would be three climate zones in total. Commenters stated that a SHGC requirement of 0.33 would then apply to all homes in the new combined climate zone. (Lippert Components, No. 152 at p. 1; MHIAZ, No. 161 at p. 3; PMHA, No. 164 at p. 3; Cavco, No. 167 at p. 1; SBRA, No. 163 at p. 3; Skyline, No. 165 at p. 2; OMHA, No. 166 at p. 2; MHI, No. 182 at p. 1; MMHA, No. 170 at p. 3; Clayton Homes, No. 185 at p. 2; Palm Harbor Homes, No. 193 at p. 1; MHISC, No. 191 at p. 2; MHIM, No. 155 at p. 3; Commodore Corporation, No. 195 at p. 3) During the June 2016 NOPR public meeting and in its written comments, ACEEE and South Mountain supported the four proposed climate zones. (ACEEE, Public Meeting Transcript, No. 148 at p. 35; ACEEE, No. 178 at p. 2; South Mountain, No. 151 at p. 1)

As part of its written comment, SBRA also performed its own analysis on SHGC for climate zones 1 and 2 and found that 0.33 for both climate zones 1 and 2 was most cost-effective for both zones. SBRA stated that it believes that DOE's analysis in the February 2015 RFI was based on an atypical set of assumptions (*e.g.,* all windows due west, no window shading, no landscaping), which it stated would be at odds with the MH working group's approach of using industry average or market representative assumptions when evaluating the economic benefits of measures that improve energy performance. (SBRA, No. 163 at p. 5) SBRA acknowledged that its analysis applied markedly different assumptions than DOE's analysis. The differences included the following: Window shading, window orientation, window area, and window cost. In addition, SBRA used the REMRate computer model, which is different than the Energy Plus 5.0 model used by DOE. (SBRA, No. 163 at p. 5)

Regarding the SHGC requirements proposed by DOE in the June 2016 NOPR, Lippert Components stated that the increased stringency on solar heat gain only really benefits those in the glazing industry, and the increased cost associated with increased stringency will reduce the sales of manufactured homes. Lippert Components suggested that the more stringent value of SHGC only be considered after real energy usage in homes has been evaluated and shows that it is a cost-viable option. (Lippert Components, No. 152 at p. 1)

For climate zone 2, RECA commented that SHGC should be 0.25, consistent with the 2015 IECC, but did not comment in the context of the number of climate zones. It stated that DOE should not diverge from the IECC value, as the statute only allows deviations from the IECC value when the code is either not cost-effective, or when ''a more stringent standard would be more cost-effective.'' RECA asserted that the IECC value of 0.25 is cost-effective, and the statute does not allow for a less stringent standard that would be more cost-effective. (RECA, No. 188 at p. 3) RECA also commented that DOE's analysis of cost effectiveness for SHGC values did not use worst-case orientation of all windows facing west. (RECA, No. 188 at p. 3) (In response to comments received on the February 2015 RFI, DOE changed the assumption from all windows oriented west to assuming an even distribution of the windows.) RECA also stated that low-SHGC fenestration is both widely available and widely used in the proposed climate zone 2. (RECA, No. 188 at p. 4) ACEEE stated that it has no objection to climate zones 1 and 2 having the same required SHGC level considering that all other aspects of the standard are the same for the two zones; however, ACEEE did not recommend any specific SHGC. (ACEEE, No. 178 at p. 2)

As already discussed in III.E.2.a of this document, DOE proposes to align the climate zones to the HUD zones (three zones) instead of the June 2016 NOPR-proposed climate zones (four zones). In addition, as detailed previously in this document, DOE is proposing energy conservation standards based on the 2021 IECC, with a tiered and untiered proposal. For Tier 1 of the tiered proposal, DOE proposes to base the standards on an incremental cost increase maximum because of concerns from HUD and stakeholders regarding the high upfront cost from the June 2016 NOPR standards. For the Tier 2 and untiered proposal, however, because of the proposed updates of the energy efficiency measures to HUD zones, DOE is proposing a glazed fenestration requirement of 0.33 for proposed climate zone 1. The proposed building thermal envelope measures are discussed in section III.E.2.b of this document.

For the energy modeling in Energy Plus 5.0, DOE used the same assumptions as the June 2016 NOPR analysis for window-to-floor area, window shading, and window cost, which were recommendations from the MH working group and formed the basis of the MH working group's deliberations and recommendations. DOE continues to find the assumptions of the MH working group appropriate and is continuing to apply them in this SNOPR rather than those assumptions from the SBRA analysis. As explained in the June 2016 NOPR, DOE did not find reason to use assumptions different from those recommended by the MH working group based on the considerations of the MH working group arriving at them. 81 FR 39756, 39772.

In addition, while DOE had originally modeled all windows facing west, based on comments received in response to the February 2015 RFI, DOE changed the assumption from all windows oriented west to assuming an even distribution of the windows. DOE maintains the assumption of uniform window distribution in the SNOPR, rather than RECA's assumption of all windows due west. As explained in the June 2016 NOPR, although the assumption of all windows facing west represents the highest energy use window orientation, consumers of manufactured homes with other window orientations would not experience as large an economic benefit. 81 FR 39756, 39772.

Regarding the window costs specifically, SBRA stated that DOE's estimate for the incremental cost to the consumer to improve the SHGC from 0.33 to 0.25 for a single-section home was too low. While DOE used an incremental cost of $91, SBRA stated that it determined that the incremental cost for the SHGC improvement would be $144. SBRA stated that it gathered pricing data from the industry's major window suppliers but did not provide the sources for this information or the calculations used to arrive at this estimate. Additionally, it did not provide its estimate for the incremental cost for multi-section homes.

In response to SBRA's comment on window costs, DOE conducted further

research on the costs of windows with comparable *U*-factor and SHGC values. DOE's research found that both DOE's and SBRA's window cost estimates are within the range of common industry costs per square foot of fenestration. Because DOE has seen no evidence that the assumptions agreed to by the MH working group are no longer representative of typical manufactured home construction, DOE continues to use the same assumptions from the MH working group for the SHGC analysis. Term Sheet, No. 107 at p. 3.

RECA commented that reduced SHGC fenestration can result in benefits like smaller air conditioning systems (which have a lower purchase price) and the reduction of peak-load electricity demand due to smaller cooling loads (and the smaller cooling equipment). (RECA, No. 188 at p. 3) In the June 2016 NOPR, DOE did not include air conditioner downsizing and associated cost savings opportunities in its SHGC analysis (or any of its cost-effectiveness analysis).

DOE recognizes that decreases in air conditioning equipment size and peak electric load may result from the proposed requirements. However, these outcomes may not happen in practice for all consumers. Further, while reduction in peak demand is a benefit to the nation, not all consumers have an energy bill pricing structure (time of use based) that would afford them direct benefits. Therefore, DOE did not introduce the uncertainty associated with these potential benefits into the LCC analysis, and instead continues to focus on the direct impacts of improvements to the building thermal envelope insulation and other energy efficiency measures.

Window/Fenestration *U*-Factors

In the June 2016 NOPR, DOE proposed window *U*-factors of 0.35 for climate zones 1, 2, and 3; and 0.32 for climate zone 4. Skyline Corporation commented that the 2015 IECC allows for window *U*-factor of 0.40 for climate zones 1 and 2, which is higher than the window *U*-factor allowed in the proposed rule. It recommended that a *U*-factor of 0.40 be used for climate zone 1. (Skyline, No. 165 at p. 2)

As already discussed, DOE is proposing to rely on the HUD zones. Further, for the Tier 2 and untiered proposals, DOE has updated the proposed requirements based on the latest version of the IECC (the 2021 IECC), in accordance with the EISA mandate. See 42 U.S.C. 17071(b)(1) Accordingly, DOE proposes updated window *U*-factor requirements based on a review of the 2021 IECC, which are summarized in Table III.8.

In the tiered proposed approach DOE is proposing as Tier 1 requirements a set of energy conservation requirements with a first-cost impact of approximately $750. The Tier 1 energy efficiency measures proposed in this document would provide energy savings exceeding that amount and are presented in section III.E.2.b. DOE has tentatively determined that a window *U*-factor of 1.08, 0.5 and 0.35 for climate zones 1, 2 and 3 respectively, in addition to the combination of the other thermal envelope measures, would provide savings above the first-cost impact in each of the proposed climate zones.

Sections R405 and R406 From the IECC

In the June 2016 NOPR, DOE did not propose including sections R405 and R406 from the IECC. Section R405 of the 2015 IECC establishes criteria for compliance using a simulated energy performance analysis, which involves calculating expected building energy use and comparing that value to the energy use of a standard reference building that complies with the minimum specifications of the 2015 IECC. Section R405 compliance is based on the total estimated annual energy usage across the whole building: Envelope, mechanical, and service water heating. Section R406 of the 2015 IECC establishes criteria for compliance using an energy rating index that contemplates the use of software to calculate the energy use of a building. DOE stated that while both sections are valid and technically feasible options, the options do not appear to offer additional flexibility in the design of a manufactured home relative to the performance requirements for the building thermal envelope.

Several commenters, however, stated that the proposed rule lacks a performance path that enables tradeoff among a wider range of energy features than the envelope alone, and recommended that DOE consider compliance options tailored for the manufactured housing industry, using section R405, *Simulated Performance Alternative,* and section R406, *Energy Rating Index Compliance Alternative,* from the 2015 IECC as models. (SBRA, No. 163 at p. 2; MHI, No. 182 at p. 8; Palm Harbor Homes, No. 193 at p. 2; NPGA, No. 171 at p. 2; AGA & APGA, No. 172 at p. 1)

Sections R405 and R406 incorporate the energy use of the whole building, including mechanical equipment such as appliances. The performance requirements in the proposed energy conservation standards are specific to the building thermal envelope only. As discussed, the MH working group generally did not recommend provisions addressing minimum appliance efficiencies and specifically identified R405 and R406 as inapplicable to manufactured homes. (MH working group, No. 107 at p. 22) Consistent with the recommendations of the MH working group, the performance requirements in the proposed energy conservation standards are specific to the building thermal envelope only, and do not provide for tradeoffs with mechanical equipment such as appliances. DOE does capture a key element of sections R405 and R406 in its performance path to compliance. The IECC does not have a $U_o$-based performance path; it instead has the options described in sections R405 and R406. Similar to those sections, a $U_o$ calculation gives the manufactured home manufacturer the flexibility to design the manufactured home, as long as the overall $U_o$ is met.

DOE also received comments regarding the use of sections R405 and R406 of the IECC, citing the use of a full-fuel-cycle (FFC) calculation in those provisions as an advantage in terms of fully accounting for the impact of homes heated with different fuel types. (NPGA, No. 171 at p. 2; AGA & APGA, No. 172 at p. 1) An FFC measure of energy includes point-of-use (site) energy; the energy losses associated with generation, transmission, and distribution of electricity; and the energy consumed in extracting, processing, and transporting or distributing primary fuels.

NPGA commented that R405 includes an exception for the performance-based compliance approach, which allows the energy use to be based on source energy by using a source energy multiplier (one for electricity and another for fuels other than electricity). NPGA stated that this exception would be consistent with DOE's approach of incorporating energy consumption and emissions beyond the site in DOE's national impact analysis. In addition, NPGA commented that the adoption of R405 would provide a means for manufacturers of HUD homes to choose appliances based on their FFC efficiency ratings, and in turn, benefit from any reductions in FFC energy consumption and carbon emissions. (NPGA, No. 171 at p. 2) AGA and APGA encouraged DOE to reconsider incorporating sections R405 or R406 of the IECC, which utilizes the FFC analysis, for the national impact analysis. (AGA & APGA, No. 172 at p. 1)

As discussed previously, sections R405 and R406 would incorporate the energy use of the whole building, including mechanical equipment. Therefore, any FFC energy use resulting from sections R405 and R406 would also include energy use of the whole building. However, for the reasons discussed, this rulemaking only proposes provisions specific to the building thermal envelope. Therefore, DOE continues to not propose requirements associated with alternative performance from the 2015 and the 2021 IECC sections R405 and R406 in this SNOPR.

Ceiling Insulation Requirement

In the June 2016 NOPR, DOE proposed that exterior ceiling insulation must have uniform thickness or a uniform density. Several commenters stated that uniform thickness will generally not be possible, and uniform density would not allow high-density insulation in the truss heel area. (SBRA, Public Meeting Transcript, No. 148 at p. 52; NEEA, Public Meeting Transcript, No. 148 at p. 53; MHIM, No. 155 at p. 3; MHIAZ, No. 161 at p. 3; PMHA, No. 164 at p. 3; Cavco, No. 167 at p. 2; SBRA, No. 163 at p. 3; Skyline, No. 165 at p. 3; OMHA, No. 166 at p. 3; MHCC, No. 162 at p. 1; MHI, No. 182 at p. 3; MMHA, No. 170 at p. 3; Clayton Homes, No. 185 at p. 3; Palm Harbor Homes, No. 193 at p. 2; MHISC, No. 191 at p. 3; Commodore Corporation, No. 195 at p. 3)

DOE tentatively agrees with commenters that the exterior ceiling insulation proposal of uniform thickness or a uniform density would prohibit effective insulation techniques. While uniform thickness and density is sound insulation installation practice in most situations, given that the space between the roof and exterior ceiling is limited, particularly at the eaves, this uniformity may not be possible at the insulation levels proposed in the NOPR. In addition, there is no requirement in the 2015 or the 2021 IECC for uniform thickness or density. Therefore, DOE is not proposing in this SNOPR to require that exterior ceiling insulation must have uniform thickness or a uniform density.

DOE requests comment on the proposal to not require that exterior ceiling insulation must have uniform thickness or a uniform density.

Total Area of Glazed Fenestration Requirement

In the June 2016 NOPR, DOE proposed a maximum ratio of 12 percent for glazed fenestration area to floor area for energy modeling purposes, consistent with the recommendation from the MH working group. DOE used this ratio as a typical housing characteristic in its analyses for determining the prescriptive requirements. DOE also required the same ratio in the proposed prescriptive requirements. DOE received several comments regarding the proposed prescriptive requirement for the maximum total area of glazed fenestration. Several commenters stated that there is no such total area of glazed fenestration requirement in the 2015 IECC, and therefore the requirement must be removed from DOE's prescriptive requirements. (Skyline, No. 165 at p. 3; MHCC, No. 162 at p. 1; MHI, No. 182 at p. 4; Clayton Homes, No. 185 at p. 3; RECA, No. 188 at p. 5; PMHA, No. 164 at p. 4; WDMA, No. 183 at p. 2)

DOE agrees that there are no similar glazing requirements in the 2015 or the 2021 IECC. DOE proposed a fenestration area to floor area limit in the June 2016 NOPR to preserve energy savings associated with the prescriptive requirements. While the performance requirements improved building thermal envelope insulation to offset larger fenestration to floor area percentages (fenestration typically has a much higher *U*-factor than an exterior wall), the prescriptive requirements would prohibit a home to be constructed primarily from fenestration. DOE now tentatively finds that a 12-percent ratio was too restrictive given current manufacturing practices for manufactured homes. Therefore, in this SNOPR, DOE is not proposing a limit on the total area of glazed fenestration. DOE still maintains that a 12-percent ratio is typical in practice and does not expect the absence of such a requirement to result in an increase in the construction of homes with larger fenestration to floor area ratios. Such design would likely be much more expensive (windows are costly relative to opaque wall), and thereby limit the increase in use of fenestration.

DOE requests comment on the proposal not to limit the total area of glazed fenestration.

Using NFRC for *U*-Factor and SHGC Values

DOE received several comments regarding the use of the National Fenestration Rating Council (''NFRC'') labels for the fenestration *U*-factor and SHGC values. RECA commented that the IECC has always had a requirement that fenestration be labeled and certified to certain NFRC standards, and that a set of default *U*-factors and SHGCs are given for fenestration that are not labeled to these standards. RECA recommended using NFRC standards to maintain consistency with the 2015 IECC, and that DOE clarify that products lacking the NFRC labels shall be assigned the default *U*-factor or SHGC values. (RECA, Public Meeting Transcript, No. 148 at p. 45; RECA, No. 188 at p. 7). Lippert Components commented that the June 2016 NOPR proposal was unclear as to when to use the default *U*-factor and SHGC values. Lippert Components stated that the MH working group intended the default *U*-factor and SHGC tables to apply to fenestration that did not have third-party certified thermal performance ratings developed in accordance with NFRC methodology. Therefore, Lippert Components suggested updating the language, and clarifying what constitutes certified ratings by using similar wording to that found in C303.1.1 in the 2015 IECC. (Lippert Components, No. 152 at p. 2)

WDMA commented that fenestration *U*-factor and SHGC should be determined with NFRC 100 and 200, respectively. WDMA also commented that the lack of a proposed test procedure leaves the proposed standards incomplete. (WDMA, No. 183 at p. 2) Additionally, ACEEE stated that the 2015 IECC (section R303.1.3) directs that fenestration generally be rated by the NFRC. It recommended incorporating this standard, stating that it will ensure consistency with site-built homes and allow for more window options. (ACEEE, No. 178 at p. 2)

NFRC standards are widely used by industry in a variety of capacities. Many component manufacturers affix an NFRC label to their fenestration products, which includes the *U*-factor, SHGC, visible transmittance, and air leakage values. The NFRC program has a large number of participants (more than 500 component manufacturers), and NFRC-certified products frequently are used to comply with local energy code requirements. In addition, a fenestration product must be NFRC-certified to meet the criteria for becoming an ENERGY STAR product. Also, the 2021 IECC reference NFRC in section R303.1.3 for fenestration product rating.

Since DOE published the June 2016 NOPR, DOE has also published the November 2016 test procedure NOPR for manufactured housing, which proposed NFRC standards to determine fenestration *U*-factor and SHGC. *See* 81 FR 78733, 78738–78739. Specifically, in the November 2016 test procedure NOPR, DOE proposed that the fenestration *U*-factors and SHGC be tested based on ANSI/NFRC 100 and

200 respectively. In addition, DOE proposed that for the prescriptive requirements, manufacturers be allowed to use either the NFRC-rated fenestration *U*-factor and SHGC values, or the default *U*-factor and SHGC values provided by DOE. Because the use of the NFRC standards applies directly to the manufactured housing test procedure, DOE will address these comments in any future action addressing testing, compliance and enforcement provisions related to these standards.

In addition, regarding NFRC labels, NEEA recommended that the final rule be explicit that the NFRC labels should remain on the windows until the house arrives at the site. (NEEA, No. 190 at p. 3) DOE's authority for this rulemaking is to establish energy conservation standards for manufactured housing as manufactured. (42 U.S.C. 17071(c)) The proposed energy conservation standards are specific only to the building thermal requirements for a manufactured home. However, DOE notes that the energy conservation standards, if finalized as proposed, would not prevent industry from pursuing this labeling practice suggested by NEEA.

Other Remaining Comments Regarding § 460.102

DOE also received individual comments regarding the proposed building thermal envelope requirements in § 460.102. ACC FSC stated that exterior foam sheathing should be listed as an alternative to cavity-only insulation. (ACC FSC, No. 186 at p. 1) For this rule as proposed, DOE is not precluding the use of foam sheathing. As long as the installed insulation would meet the building thermal envelope requirements, as finalized, then it would be an acceptable option for use in a manufactured home.

ACC FSC also specifically requested that DOE add an ''R13+5ci'' [31] option to climate zones 3 and 4 for the wall *R*-value under the prescriptive path. (ACC FSC, No. 186 at p. 1) As long as the installed insulation would meet the adopted building thermal envelope requirements, the proposed requirements would not prohibit certain insulation options from being used in the manufactured home.

c. Proposed § 460.103 Installation of Insulation

Consistent with the June 2016 NOPR, DOE proposes in § 460.103 of the regulatory text to require manufacturers to install insulation according to both the insulation manufacturer's installation instructions and the instructions set forth in proposed Table 460.103. DOE also proposes to require manufacturers to comply with the insulation manufacturer's installation instructions to ensure that the intended performance of the insulation is achieved. Further, consistent with the June 2016 NOPR, DOE proposes to add as part of a new Table 460.103 several component installation requirements, including general requirements, and requirements for access hatches, panels and doors, baffles, ceiling or attic, eave vents, narrow cavities, rim joists, shower or tub adjacent to exterior wall, and walls.

The following paragraphs discuss comments DOE received regarding the installation of insulations requirements proposed in the June 2016 NOPR, and any other corresponding proposed changes to the June 2016 NOPR requirements based on comments received, or updates to the 2021 IECC.

DOE received a comment on the June 2016 NOPR regarding the quality of insulation installation. Wisconsin Energy Conservation Corporation (WECC) commented that the overall quality of the insulation installation is important to avoid any degradation in insulation performance. (WECC, No. 150 at p. 3) Consistent with the 2015 and the 2021 IECC, DOE has maintained that insulation is to be installed according to the manufacturer's instructions to ensure the insulation achieves its rated *R*-value.

DOE received several comments on the June 2016 NOPR regarding the exterior floor insulation requirements. In general, commenters stated that the provision requiring exterior floor insulation be placed in contact with the subflooring material be removed because the requirement is not supported by building scientists; DOE has not demonstrated its value for manufactured home energy efficiency; assuming the bottom board acts as the air barrier (as seen in Table 460.104) obviates the need for the insulation to be in contact with the decking; the overall efficiency of the home decreases as exterior floor insulation between I-beams is usually placed beneath ducts (effectively moving the ducts inside the thermal envelope minimizing thermal losses); and it is difficult to do in a factory setting. (MHIM, No. 155 at p. 3; MHIAZ, No. 161 at p. 3; PMHA, No. 164 at p. 3; Cavco, No. 167 at p. 1; SBRA, No. 163 at p. 3; OMHA, No. 166 at p. 3; MHI, No. 182 at p. 3; MMHA, No. 170 at p. 3; Clayton Homes, No. 185 at p. 3; Palm Harbor Homes, No. 193 at p. 2; MHISC, No. 191 at p. 3; Commodore Corporation, No. 195 at p. 3; Skyline, No. 165 at p. 3; MHCC, No. 162 at p. 1).

During the public meeting, NEEA also stated that the permanent contact with the underside of the subfloor is virtually impossible in the center of a manufactured home. (NEEA, Public Meeting Transcript, No. 148 at p. 55) WECC commented that it is impractical to require insulation to completely contact the subfloor; completely filling the floor with insulation results in cooler floor temperatures leading to consumer complaints. WECC also questioned how the insulation under the ductwork will be supported and maintained, and to what extent the cross-braces have an effect on compaction of increased fiberglass. Overall, WECC stated that it sees many logistical problems with the extra levels of insulation. (WECC, No. 150 at p. 2)

The requirement that exterior floor insulation installed must maintain permanent contact with the underside of the subfloor is found in the 2015 IECC, which was the basis of the June 2016 NOPR requirement. However, a study provided by MHI and other stakeholders shows that this requirement is not necessary and can actually be harmful to homes.[32] The study finds that installing insulation on the underside of the floor decking results in the wood floor joists from the floor framing to get cold enough that the temperature falls below the dewpoint temperature of the air in the crawlspace. The low temperatures would therefore form condensation on the surface of the wood, which could affect the integrity of the flooring. Based on the comments received, including the cited study, DOE tentatively agrees that it is inappropriate for MH manufacturers to give insulation permanent contact under the whole subfloor. In addition, in manufactured homes, the common practice is to lay blanket insulation over the duct work below the floor, placing the ducts between the insulation and the rough floor decking, which creates a pocket of air between the blanket insulation and the rough floor decking in the space near the ducts. Therefore, by taking into account common manufactured home

[31] The first value is cavity insulation and the second value is continuous insulation. Therefore, ''13+5'' would mean *R*-13 cavity insulation plus *R*-5 continuous insulation. In general, the cavity insulation is interrupted by framing members, which lets heat through more readily, whereas continuous insulation is uninterrupted. Therefore, a layer of cavity insulation is less effective than a layer of continuous insulation for the same *R*-value. To calculate the wall assembly's overall *R*-value, as would be required under the proposed rule, one would need to use the Battelle method, which references the ASHRAE HOF.

[32] Lstiburek, Joseph, BSI–009: New Light in Crawlspaces, Building Science Corporation (2010), et al.

building practice, in this SNOPR, DOE is deviating from the 2015 and the 2021 IECC and proposes to remove the requirement that exterior floor insulation installed must maintain permanent contact with the underside of the rough floor decking over which the finished floor, flooring material, or carpet is laid.

DOE requests comment on removing the proposed requirement that exterior floor insulation installed must maintain permanent contact with the underside of the rough floor decking.

DOE also received several comments specifically on duct material and insulation. Cavco and Pfeffer stated that high-density duct board and flex duct is subject to severe rodent degradation over time, and so ductwork material should be considered in the rulemaking. (Cavco, Public Meeting Transcript, No. 148 at p. 67; Pfeiffer, No. 150 at p. 1) WECC and NCJC advocated using metal ductwork for the entire duct system. Metal ductwork is less susceptible to damage from animals, water, and moisture degradation. (WECC, No. 150 at p. 1; NCJC, No. 184 at p. 2) In addition, WECC commented that both the flex duct and duct boards that are commonly used are capable of being crushed or compressed, which reduces efficiency, as well as being hard to install and permanently repair. (WECC, No. 150 at p. 1)

EISA directs DOE to establish energy conservation standards for manufactured housing. While there may be an issue with the reliability of certain building materials, this issue only indirectly relates to the energy efficiency of manufactured homes and is beyond the scope of this rulemaking. Therefore, DOE is not assessing or proposing regulations relating to duct material.

Regarding duct insulation, NEEA recommended that *R*-8 insulation should be required everywhere where ducts are not embedded in insulation. This specifically ensures that ducts under the floor are insulated. (NEEA, No. 190 at p. 3) VEIC stated that HVAC ductwork located in the floor assembly with crossover ducts should be eliminated and relocated inside the thermal envelope, as this would improve energy performance and increase durability. (VEIC, No. 187 at p. 2) NEEA commented that all crossover ducts should have *R*-8 insulation. (NEEA, No. 190 at p. 3)

DOE's research indicates that HVAC ducts are generally located between the floor and the insulation and are therefore within the conditioned space. Cavco also commented that the common practice on entry-level products is to locate them in the floor. (Cavco, Public Meeting Transcript, No. 148 at p. 65) Therefore, because ducts are already located within the conditioned space, and would already be insulated because of the insulation required within the conditioned space, DOE is not proposing any additional insulation for ducts in this SNOPR.

NEEA and WSU Energy Program stated that a clearer statement on how insulation should contain no voids or compression as installed, is necessary. (NEEA, No. 190 at p. 2; WSU Energy Program, Public Meeting Transcript, No. 148 at p. 54, 57). Manufacturer installation instructions specify that insulation be installed per the insulation chart. Insulation charts, depending on the type of insulation, are required by the Federal Trade Commission (''FTC'') to show the *R*-value for a certain insulation thickness, or at an installed thickness. 16 CFR 460.12. Because DOE requires that insulation must be installed according to the insulation manufacturer's installation instructions, the MH manufacturer would have to determine the correct thickness for the *R*-value required in the manufactured home.[33] Any compression would result in a different thickness, which would in turn change the *R*-value of the insulation. Additionally, certain insulation manufacturer's installation instructions specifically state that compression must be avoided when installing insulation, because compression will reduce the *R*-value. Likewise, insulation manufacturer's installation instructions also state that there cannot be gaps between pieces of insulation, as it can reduce the installed *R*-value of insulation.[34] Therefore, DOE continues to find the requirements proposed in section 460.103 of the June 2016 NOPR are sufficient to prohibit compression and voids, and DOE continues to propose these requirements without change, consistent with R303.2 of the 2021 IECC.

The 2021 IECC included several updates (relative to the 2015 IECC) in sections R402.2 through R402.3 and Table R402.4.1.1 for insulation installation criteria relevant to manufactured housing, which are discussed in Table III.13.

TABLE III.13—THE 2021 IECC UPDATES FOR INSTALLATION OF INSULATION

| Component | June 2016 NOPR proposal | The 2021 IECC updates, SNOPR proposal |
|---|---|---|
| General | Air-permeable insulation must not be used as a material to establish the air barrier. | No relevant updates made from the 2015 IECC to the 2021 IECC. Therefore, DOE proposes no changes between the 2016 NOPR and this SNOPR. |
| Access hatches, panels, and doors. | Access hatches, panels, and doors between conditioned space and unconditioned space must be insulated to a level equivalent to the insulation of the surrounding surface, must provide access to all equipment that prevents damaging or compressing the insulation, and must provide a wood-framed or equivalent baffle or retainer when loose fill insulation is installed within an exterior ceiling assembly to retain the insulation both on the access hatch, panel, or door and within the building thermal envelope. | Relevant updates from the 2015 IECC to the 2021 IECC include requiring access hatches and doors from conditioned to unconditioned spaces be insulated to the same *R*-value required by Table R402.1.3 for the wall or ceiling in which they are installed, with certain exceptions. For this SNOPR, DOE is seeking comment on whether the 2021 IECC update applies to manufactured homes. |

[33] Green Fiber insulation fact sheet; *https://www.greenfiber.com/uploads/documents/Fact-Sheet-INS541LD-19.05LB-Retail-Bag.pdf.*

[34] CertainTeed sustainable insulation installation manual; *https://www.buildsite.com/pdf/certainteed/CertainTeed-Sustainable-Insulation-Installation-Instructions-1814058.pdf.*

TABLE III.13—THE 2021 IECC UPDATES FOR INSTALLATION OF INSULATION—Continued

| Component | June 2016 NOPR proposal | The 2021 IECC updates, SNOPR proposal |
|---|---|---|
| Baffles | Baffles must be constructed using a solid material, maintain an opening equal or greater than the size of the vents, and extend over the top of the attic insulation. | Relevant updates from the 2015 IECC to the 2021 IECC include requirements that the baffle be installed to the outer edge of the exterior wall top plate so as to provide maximum space for attic insulation coverage over the top plate. In addition, where soffit ventilation is not continuous, requires that baffles be installed continuously to precent ventilation air in the eave soffit from bypassing the baffle.<br>For this SNOPR, DOE is seeking comment on whether the 2021 IECC update applies to manufactured homes. |
| Ceiling or attic | The insulation in any dropped ceiling or dropped soffit must be aligned with the air barrier. | No relevant updates made from the 2015 IECC to the 2021 IECC. Therefore, DOE proposes no changes between the 2016 NOPR and this SNOPR. |
| Eave vents | Air-permeable insulations in vented attics within the building thermal envelope must be installed adjacent to eave vents. | No relevant updates made from the 2015 IECC to the 2021 IECC. Therefore, DOE proposes no changes between the 2016 NOPR and this SNOPR. |
| Floors | Floor insulation must be installed to maintain permanent contact with the underside of the rough floor decking over which the finished floor, flooring material, or carpet is laid, except where air ducts directly contact the underside of the rough floor decking. | No relevant updates made from the 2015 IECC to the 2021 IECC. However, as previously discussed in this section, DOE is no longer proposing this requirement from the June 2016 proposal. |
| Narrow cavities | Batts in narrow cavities must be cut to fit or narrow cavities must be filled with insulation that upon installation readily conforms to the available cavity space. | Relevant updates from the 2015 IECC to the 2021 IECC were editorial in nature and intended to improve clarity.<br>DOE proposes to include these updates in this SNOPR. |
| Rim joists | Rim joists must be insulated | Relevant updates from the 2015 IECC to the 2021 IECC include additional updates that the insulation be installed such that the insulation maintain permanent contact with the exterior rim board.<br>DOE proposes to include this update in this SNOPR as it provides further clarity on how the rim joists must be insulated. |
| Shower or tub adjacent to exterior wall. | Exterior walls adjacent to showers and tubs must be insulated. | No relevant updates made from the 2015 IECC to the 2021 IECC. Therefore, DOE proposes no changes between the 2016 NOPR and this SNOPR. |
| Walls | Air permeable exterior building thermal envelope insulation for framed exterior walls must completely fill the cavity, including within stud bays caused by blocking lay flats or headers. | No relevant updates made from the 2015 IECC to the 2021 IECC. Therefore, DOE proposes no changes between the 2016 NOPR and this SNOPR. |
| Shaft, penetrations | None | Relevant updates from the 2015 IECC to the 2021 IECC include requirements that the insulation shall be fitted tightly around utilities passing through shafts and penetrations in the building thermal envelope to maintain required *R*-value.<br>For this SNOPR, DOE is seeking comment on whether the requirement generally applies to manufactured homes. |

The 2021 IECC also includes building thermal envelope updates for mass walls, steel-framed buildings, basement walls, slab-on grade floors, crawl space walls, sunroom and heated garage insulation. DOE has not included these requirements in the proposed rule because they are not directly relevant to manufactured housing.

DOE requests comment on the proposed updates to the installation of insulation criteria as it applies to manufactured homes construction only.

DOE requests comments on whether there are any of the 2021 IECC updates relevant to manufactured housing that should be considered as part of this rulemaking. Specifically, DOE requests comment on whether the 2021 IECC updates for installation criteria for access hatches and doors, baffles and shafts are applicable to manufactured housing and should be considered in this rulemaking.

d. Proposed § 460.104 Building Thermal Envelope Air Leakage

Consistent with the June 2016 NOPR, DOE proposes to add a new § 460.104 that would require manufacturers to seal manufactured homes against air leakage. Air leakage sealing limits air infiltration through the building thermal envelope, in turn reducing heating and cooling loads. Proposed § 460.104 would specify both general and specific requirements for sealing a manufactured home to prevent air leakage, all of which are based on Table R402.4.1.1 of the 2015 IECC with modifications based on recommendations from the MH working group (Term Sheet No. 107 at p. 5) and any further modifications based on DOE's review of the 2021 IECC (discussed further in this section). The MH working group also recommended prescriptive air leakage sealing requirements that are designed to achieve an overall air exchange rate of five air changes per hour (ACH) within a manufactured home. Term Sheet No. 107 at p. 5.

The proposed general requirements in § 460.104 would require that manufacturers properly seal all joints, seams, and penetrations in the building thermal envelope to establish a continuous air barrier, and use appropriate sealing materials to allow for differential expansion and contraction of dissimilar materials. The proposed specific requirements in Table 460.104 include air barrier criteria for

ceiling or attic, duct system register boots, electrical box or phone on exterior walls, floors, mating line surfaces, recessed lighting, rim joists, shower or tub adjacent to exterior wall, walls and windows, skylights and doors.

In developing its recommendations, the MH working group also identified concerns regarding the potential impacts of the air sealing requirements on the indoor air quality in manufactured homes, but understood indoor air quality to be outside the scope of the working group. (MH Working Group Meeting Transcript No. 115, pp. 95–96)

Prior to issuing the 2016 EA–RFI, DOE issued a request for information (RFI) regarding ''data, studies, and other such materials that address the relationship between potential reductions in levels of natural air infiltration and both indoor air quality and occupant health for a manufactured home.'' (June 25, 2013, 78 FR 37995). Specifically, DOE requested information on the relationship between potential reductions in levels of natural air infiltration and both indoor air quality and occupant health for a manufactured home. 78 FR 37995, 37996. With regard to indoor air quality, one commenter mentioned that reductions in air leakage can lead to increased formaldehyde concentrations and noted that increased mechanical ventilation also can increase moisture infiltration in humid climates, potentially leading to deleterious impacts such as mold growth. (MHARR, No. 36 at pp. 6–7) Several commenters suggested including measures approved by the MHCC at the time, including requirement for carbon monoxide alarms, vent termination separation from air intake and an option for individual manufacturers to adopt ASHRAE Standard 62.2. (Joint commenters,[35] No. 38 at p. 2; NEEA, No. 40 at p. 3) NEEA also recommended NFPA 501 standard for window and door flashing and weather resistant barriers to improve durability and reduce moisture-related indoor air quality problems associated with wind driven rain and long-term failure of the building envelope siding and window systems. (NEEA, No. 40 at p. 3) Several other commenters noted that there have been no reported issues with occupant health in energy efficient homes that have been sealed tightly to reduce air infiltration. (MHI, No. 39, at p. 5; Joint commenters, No. 38 at p. 2) Specifically, whole house mechanical ventilation systems have been incorporated into the HUD MHCSS for nearly 20 years. (Joint commenters, No. 38 at p. 2) Further, NEEA noted that for voluntary energy efficiency programs (*i.e.,* EPA ENERGY STAR homes and DOE Challenge home) the few IAQ problems encountered were associated with HVAC commissioning and/or occupant education, not with building tightness. (NEEA, No. 40 at p. 3)

In the June 2016 NOPR, DOE again requested information on the relationship between a reduction in levels of natural air infiltration (through sealing leaks in the building thermal envelope) and health and safety. 81 FR 39756, 39798. In response to the June 2016 NOPR, DOE did not receive any studies or data regarding the potential impact on health and safety from reduced levels of natural air infiltration in a manufactured home. However, DOE is considering measures to mitigate potential adverse impacts to indoor air quality that could arise from this SNOPR proposal. See section III.E.3.d of this document for further details.

The following paragraphs discuss comments DOE received regarding the building thermal envelope air leakage requirements proposed in the June 2016 NOPR, and any other corresponding proposed changes to the June 2016 NOPR requirements based on comments received, or updates to the 2021 IECC.

WSU Energy Program commented that ACH rate of five can be achieved through the prescriptive approaches recommended by the MH working group and that to ensure it is met, specific direction must be provided as to the areas required to be sealed and further that DOE needs to provide education and training to MH manufacturers. (WSU Energy Program, Public Meeting Transcript, No. 148 at p. 57)

As discussed, the June 2016 proposed envelope air leakage requirements were based on Table R402.4.1.1 of the 2015 IECC with modifications. The IECC applies generally to residential buildings, including site-built and modular housing, and is not specific to manufactured housing. As stated by WSU Energy Program in its comments, the building thermal envelope air leakage requirements (as proposed in § 460.104) are prescriptive requirements intended to achieve an envelope tightness of five ACH when depressurized to 50 pascals. Term Sheet, No. 107 at p. 5. Further, DOE reviewed the 2021 IECC and is proposing additional updates to the air barrier criteria, as discussed later in this section.

NEEA commented that a clearer definition of how a proper air barrier should be designed was needed in order to make construction requirements more specific, and to establish a single meaning without ambiguity. (NEEA, No. 190 at p. 2). NEEA did not provide a further explanation of how the proposed requirements for an air barrier were lacking or presented an opportunity for misapplication. As stated earlier in this section, DOE has listed many specific requirements for proper air barrier installation in Table 460.104. These requirements were based on Table R402.4.1.1 of the 2015 IECC and related recommendations from the MH working group. Further, DOE reviewed the 2021 IECC to make any additional updates to the air barrier criteria.

DOE also received a comment regarding installation requirements. VEIC stated that the rule should also have clear installation requirements for insulation, as well as for air and duct sealing. (VEIC, No. 187 at p. 2) DOE notes that its proposal would require that insulation and air leakage sealing must be done according to manufacturer's instructions, and the requirements set forth in proposed §§ 460.103 and 460.104, accordingly.

WDMA recommended that a provision regarding fenestration air leakage requirements be added. WDMA stated that provisions regarding fenestration air leakage are necessary for natural air infiltration limits required by the IECC to be met. WDMA cited section R402.4.3 of the 2015 IECC as an example. (WDMA, No. 183 at p. 3) As stated in the June 2016 NOPR, DOE did not include specifications for air leakage of fenestration consistent with the MH working group recommendation to reduce testing burden. In addition, as discussed in the following paragraphs, DOE is proposing air leakage requirements at the full building thermal envelope level, which will capture any air leakage associated with installed fenestration. Additionally, the proposed prescriptive building thermal envelope air leakage standards include requirements to seal the space between fenestration and framing. Therefore, DOE is not proposing fenestration specific quantitative air leakage requirements.

DOE also received several comments on the June 2016 NOPR regarding the building's air barrier. NEEA recommended that the standards be explicit that the multi-section marriage line air seal shall be installed at the factory with proper quality control rather than being installed in the field.

[35] The letter comprised the joint comments of ACEE, MHI, National Association of State Energy Officials, National Consumer Law Center (on behalf of its low-income clients), National Manufactured Home Owners Association, Natural Resources Defense Council, Northwest Power & Conservation Council, and SBRA.

(NEEA, No. 190 at p. 3) All requirements proposed in this SNOPR would apply to the manufactured home as manufactured, *i.e.,* the manufacturer of the manufactured home is responsible for ensuring compliance with the requirements proposed in this SNOPR. (42 U.S.C. 17071(c)) A manufactured home would have to comply with the requirements, once finalized, prior to being installed in the field. DOE proposes to clarify in § 460.1 that the requirements apply to the manufactured home as manufactured, prior to installation.

DOE also received a comment regarding the duct system register boots air barrier installation criteria. The June 2016 NOPR proposed that duct system register boots that penetrate the building thermal envelope or the air barrier must be sealed to the air barrier or the interior finish materials with caulk, foam, gasket, or other suitable material. WECC recommended that boot penetration be sealed to the subfloor. In WECC's experience with retrofit work, sealing to a finished vinyl flooring surface causes the flooring to float when the air handler is energized. (WECC, Public Meeting Transcript, No. 148 at p. 61) DOE reinvestigated this topic and acknowledges that the 2015 IECC requires that the duct register boots that penetrate building thermal envelope be sealed to the subfloor or drywall. The MH working group also voted to include this statement from the 2015 IECC in the term sheet. Term Sheet, No. 107 at p. 19. The 2018 and the 2021 IECC replaces the use of the term ''drywall'' with ''wall covering or ceiling penetrated by the boot.'' In this SNOPR, DOE is proposing to revise its earlier proposed regulatory text in Table 460.104 regarding register boots consistent with the language in the 2021 IECC to clarify that duct systems register boots may also be sealed to the subfloor. DOE is proposing the following air barrier criteria for duct system register boots in this SNOPR: ''Duct system register boots that penetrate the building thermal envelope or the air barrier must be sealed to the subfloor, wall covering or ceiling penetrated by the boot, air barrier, or the interior finish materials with caulk, foam, gasket, or other suitable material.'' This revision provides added flexibility, addresses WECC's concern, and follows the provisions of the 2021 IECC and the recommendations of the MH working group.

Further, DOE considered several other updates of the 2021 IECC in section R402.4 and Table R402.4.1.1 (relative to the 2015 IECC) for air barrier criteria relevant to manufactured housing—see Table III.14.

TABLE III.14—THE 2021 IECC UPDATES FOR AIR BARRIER CRITERIA

| Component | June 2016 NOPR proposal | The 2021 IECC updates; SNOPR proposal |
|---|---|---|
| Ceiling or attic | The air barrier in any dropped ceiling or dropped soffit must be aligned with the insulation and any gaps in the air barrier must be sealed with caulk, foam, gasket, or other suitable material. Access hatches, panels, and doors, drop-down stairs, or knee wall doors to unconditioned attic spaces must be weather-stripped or equipped with a gasket to produce a continuous air barrier. | No relevant updates made from the 2015 IECC to the 2021 IECC. Therefore, DOE proposes no changes between the 2016 NOPR and this SNOPR. |
| Duct system register boots*. | Duct system register boots that penetrate the building thermal envelope or the air barrier must be sealed to the air barrier or the interior finish materials with caulk, foam, gasket, or other suitable material. | As previously discussed, DOE proposes to update this requirement consistent with the 2021 IECC. |
| Electrical box or phone box on exterior walls. | The air barrier must be installed behind electrical or communication boxes or the air barrier must be sealed around the box penetration with caulk, foam, gasket, or other suitable material. | Relevant updates from the 2015 IECC to the 2021 IECC include a clarification that the air barrier shall be installed behind electrical ''and'' communication boxes, not ''or''. DOE proposes to update this requirement in this SNOPR. |
| Floors | The air barrier must be installed at any exposed edge of insulation. The bottom board may serve as the air barrier. | No relevant updates made from the 2015 IECC to the 2021 IECC. Therefore, DOE proposes no changes between the 2016 NOPR and this SNOPR. |
| Mating line surfaces | Mating line surfaces must be equipped with a continuous and durable gasket. | No relevant updates made from the 2015 IECC to the 2021 IECC. Therefore, DOE proposes no changes between the 2016 NOPR and this SNOPR. |
| Recessed lighting | Recessed light fixtures installed in the building thermal envelope must be sealed to the drywall with caulk, foam, gasket, or other suitable material. | Relevant updates from the 2015 IECC to the 2021 IECC include requiring sealing in accordance with section R402.4.5, which includes specific air leakage rate requirements.<br>Considering the original proposal was determined to be prescriptive only, DOE is not including the updates in this SNOPR, but is requesting comment on this. |
| Rim joists | The air barrier must enclose the rim joists | Relevant updates from the 2015 IECC to the 2021 IECC include updates that the junctions of the rim board to the sill plate and the rim board and the subfloor shall be air sealed.<br>DOE proposes to include this update in this SNOPR as it provides further clarity on how the rim joists must be sealed. |
| Shower or tub adjacent to exterior wall. | The air barrier must separate showers and tubs from exterior walls. | No relevant updates made from the 2015 IECC to the 2021 IECC. Therefore, DOE proposes no changes between the 2016 NOPR and this SNOPR. |
| Walls | The junction of the top plate and the exterior ceiling, and the junction of the bottom plate and the exterior floor, along exterior walls must be sealed with caulk, foam, gasket, or other suitable material. | No relevant updates made from the 2015 IECC to the 2021 IECC. Therefore, DOE proposes no changes between the 2016 NOPR and this SNOPR. |

TABLE III.14—THE 2021 IECC UPDATES FOR AIR BARRIER CRITERIA—Continued

| Component | June 2016 NOPR proposal | The 2021 IECC updates; SNOPR proposal |
|---|---|---|
| Windows, skylights, and exterior doors. | The rough openings around windows, exterior doors, and skylights must be sealed with caulk or foam. | No relevant updates made from the 2015 IECC to the 2021 IECC. Therefore, DOE proposes no changes between the 2016 NOPR and this SNOPR. |
| Shafts, penetration ... | Sealing methods between dissimilar materials must allow for differential expansion and contraction and must establish a continuous air barrier upon installation of all opaque components of the building thermal envelope.<br>All gaps and penetrations in the exterior ceiling, exterior floor, and exterior walls, including ducts, flue shafts, plumbing, piping, electrical wiring, utility penetrations, bathroom and kitchen exhaust fans, recessed lighting fixtures adjacent to unconditioned space, and light tubes adjacent to unconditioned space, must be sealed with caulk, foam, gasket or other suitable material. | Relevant updates from the 2015 IECC to the 2021 IECC clarifies that sealing should allow for expansion, contraction and mechanical vibration.<br>DOE proposes to include the term ''mechanical vibration'' to provide further clarity. |
| Narrow cavities ..... | None ..... | Relevant updates from the 2015 IECC to the 2021 IECC include updates that narrow cavities of 1 inch or less that are not able to be insulated shall be air sealed.<br>For this SNOPR, DOE is not proposing to include this update because DOE is unsure how it would affect the June 2016 NOPR conclusion that the proposed prescriptive air leakage sealing requirements are designed to achieve 5 ACH. DOE requests comment on this topic. |
| Plumbing, wiring or other obstructions. | None ..... | Relevant updates from the 2015 IECC to the 2021 IECC include update that all holes created by wiring, plumbing or other obstructions in the air assembly must be air sealed.<br>For this SNOPR, DOE is not proposing to include this update because DOE is unsure how it would affect the June 2016 NOPR conclusion that the proposed prescriptive air leakage sealing requirements are designed to achieve 5 ACH. DOE requests comment on this topic. |

* Updates based on comments received to the June 2016 NOPR.

The 2021 IECC also includes air barrier criteria updates for basement crawl space and slab foundations, garage separation, and concealed sprinklers. DOE has not included these requirements in the proposed rule because they are not directly relevant to manufactured housing.

DOE requests comment on the proposed updates to the air barrier criteria as it applies to manufactured homes construction only. Further, DOE requests comment whether the SNOPR proposal continues to be designed to achieve air leakage sealing requirements of 5 ACH.

DOE requests comments on whether there are any of the 2021 IECC updates relevant to manufactured housing that should be considered as part of this rulemaking. Specifically, DOE requests comment on whether the 2021 IECC updates for air barrier criteria for recessed lighting, narrow cavities and plumbing are applicable to manufactured housing and should be considered in this rulemaking. If so, DOE requests comment on whether the requirements would alter the 5 ACH designation.

3. Subpart C: HVAC, Service Water Heating, and Equipment Sizing

Subpart C proposes requirements that would be applicable to manufactured homes related to ducts; HVAC; service hot water systems; mechanical ventilation fan efficacy; and heating and cooling equipment sizing. The proposed subpart C requirements would be applicable to all manufactured homes under either the proposed rule or the tiered proposed rule (*i.e.,* under the tiered proposed rule the subpart C requirements would be applicable to Tier 1 and Tier 2 manufactured homes). The following sections provide further details regarding Subpart C.

a. Proposed § 460.201 Duct System

DOE proposes to include in § 460.201(a) a requirement that manufactured homes equipped with a duct system be designed to limit total air leakage to less than or equal to 4 cubic feet per minute (''cfm'') per 100 square feet of conditioned floor area. DOE initially determines this proposal to be consistent with R403 of the 2021 IECC. In addition, DOE also proposes to require that building framing cavities not be used as ducts or plenums under § 460.201(a), consistent with the 2021 IECC and the recommendation of the MH working group (Term Sheet, No. 107 at p. 1). Building framing cavities are typically not tightly sealed and do not provide an adequate barrier to foreign bodies for air quality reasons. The use of building framing cavities as ducts and plenums is generally considered to be poor construction practice and is not a typical practice in the manufactured housing industry.

The following paragraphs discuss comments DOE received regarding the duct system requirements proposed in the June 2016 NOPR, and any other corresponding proposed changes to the June 2016 NOPR requirements based on comments received, or updates to the 2021 IECC.

The majority of the comments were recommending more specificity on the proposed duct sealing requirements. Several commenters suggested that the duct leakage requirements should only be applicable to homes that are equipped with a duct system, so as not to prohibit use of a ductless HVAC system. (MHIM, No. 155 at p. 3; MHIAZ, No. 161 at p. 3; PMHA, No. 164 at p. 4; Cavco, No. 167 at p. 2; SBRA, No. 163 at p. 4; OMHA, No. 166 at p. 3; MHI, No. 182 at p. 4; Clayton Homes, No. 185 at p. 3; Palm Harbor Homes, No. 193 at p. 2; MHISC, No. 191 at p. 3; SBRA,

Public Meeting Transcript, No. 148 at p. 59; Commodore Corporation, No. 195 at p. 3; Skyline, No. 165 at p. 3; MHCC, No. 162 at p. 2; NEEA, No. 190 at p. 3)

In the June 2016 NOPR, DOE proposed to include in section 460.201(a) a requirement that manufacturers equip each manufactured home with a duct system designed to limit total air leakage to less than or equal to 4 cubic feet per minute (cfm) per 100 square feet of conditioned floor area. DOE agrees with the commenters that each manufactured home should not be required to have a duct system. An implicit requirement for including a duct system would prohibit usage of ductless HVAC systems, which could improve the energy performance of the home.[36] Therefore, in this SNOPR, DOE proposes to require only manufactured homes with duct systems to limit total duct air leakage to less than or equal to 4 cfm per 100 square feet of conditioned floor.

DOE received other comments regarding the design of duct systems. Skyline Corporation and MHCC questioned the wording of proposed § 460.201 Duct Systems—section (b), which stated, ''building framing cavities must not be used as ducts or plenums.'' They stated this is ambiguous as to whether it applies to return air plenums. They recommended that the section be revised to include ''. . . as ducts or plenums when directly connected to mechanical systems.'' (Skyline, No. 165 at p. 3; MHCC, No. 162 at p. 2) Clayton Homes stated that proposed § 460.201(a), the last sentence should be changed to read ''Building framing cavities must not be used as supply ducts or plenums.'' Clayton Homes commented that the addition of the word ''supply'' will enable cavities to be used for return air, as intended and allowed by the IECC. (Clayton Homes, No. 185 at p. 4) DOE agrees with commenters that return air plenums should not be included in the requirement because they are free-flowing and generally not ducted. Therefore, DOE is proposing to state the return air plenums are not included.

DOE also received a comment on higher performing duct systems. WSU Energy Program commented that some manufacturers are looking toward higher performing duct systems than the minimum standards, and there is no incentive for manufacturers to use these better performing systems (*e.g.,* ductless mini-split heat pumps, and other HVAC systems without a central duct system). It also commented that there could be a prescriptive requirement or alternative option for a manufacturer willing to redesign its manufactured homes so that the supply ducts would be within the thermal envelope. (WSU Energy Program, Public Meeting Transcript, No. 148 at p. 60) As noted, DOE has based its proposed energy conservation standards for manufactured homes on the most recent IECC, as directed by EISA. (42 U.S.C. 17071(b)(1)) DOE emphasizes that the energy conservation standards proposed in this SNOPR are minimum standards, but this does not prohibit manufacturers from employing more efficient measures.

NEEA recommended that the standard include specifics on air leakage testing on ducts to be performed, and that duct leakage be tested in the factory. (NEEA, No. 190 at p. 2) As discussed previously, DOE is not addressing a test procedure in this rulemaking.

DOE also reviewed the updates to section R403.3.4 of the 2021 IECC (relative to the 2015 IECC reviewed by the MH Working Group) as it relates to duct sealing and leakage. As previously discussed, DOE is not proposing any testing provisions at this time. As it relates to duct leakage requirements, DOE notes that section R403.3.6 of the 2021 IECC was updated to require that for ducts and air handlers that are located entirely within building thermal envelope, the total leakage would be less than or equal to 8 cfm per 100 square feet of conditioned floor area. For manufactured homes, DOE notes that it is not always the case that ducts and air handlers are located entirely within the building thermal envelope. Accordingly, for this rulemaking, DOE continues to propose the MH Working Group recommendation that total air leakage of duct systems is to be less than or equal to 4 cfm per 100 square feet of conditioned floor area under a post-construction test.

DOE requests comment on the proposal to require that total air leakage of duct systems for all manufactured homes is to be less than or equal to 4 cfm per 100 square feet of conditioned floor area.

b. Proposed § 460.202 Thermostats and Controls

Consistent with the June 2016 NOPR, DOE proposes including specifications for thermostats in § 460.202(a) of the regulatory test based on the IECC. Section R403.1 of the 2015 and 2021 IECC specifies that at least one thermostat shall be provided for each separate heating and cooling system. DOE also proposes specifications for programmable thermostats in § 460.202(b), based on section R403.1.1 of the 2015 and 2021 IECC. Section R403.1.1 of the 2015 and 2021 IECC also specifies that the thermostat controlling the primary heating or cooling system must be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day. In addition, consistent with the June 2016 NOPR, DOE proposes to include in § 460.202(c) specifications for heat pumps having supplementary heat, based on section R403.1.2 of the 2015 and 2021 IECC.

The following paragraphs discuss comments DOE received regarding the thermostat and controls requirements proposed in the June 2016 NOPR, and any other corresponding proposed changes to the June 2016 NOPR requirements based on comments received, or updates to the 2021 IECC.

Regarding thermostat control, NEEA recommended that the final rule be explicit that the electric resistance lockout in central heat pump systems when the outdoor air temperature is greater than 40 °F. (NEEA, No. 190 at p. 3). While section R403.1.2 of the 2015 and the 2021 IECC provides requirements for the shutoff of heat pumps having supplementary electric-resistance heat under certain conditions, the 2015 and the 2021 IECC do not provide any temperature specifications for this shutoff. Therefore, DOE did not consider these requirements in the proposed energy conservation standards.

DOE also reviewed the updates to sections R403.1 of the 2021 IECC (relative to the 2015 IECC reviewed by the MH Working Group) as it relates to thermostats and controls. DOE notes that section R403.1 is no longer identified as ''mandatory'' in the 2021 IECC. DOE's understanding of this update is that no technical changes were intended, rather the removal of the label ''mandatory'' was only to make the IECC more understandable and easier to use because the label ''mandatory'' was not used consistently in the IECC. The 2021 IECC prescriptive compliance option application described in section R401.2.1 continues to require compliance with section R403.1, regardless of whether the label ''mandatory'' is included in that section. Therefore, DOE preliminarily concludes this update is not a substantive change. In addition, DOE observed that the programmable thermostat requirements were updated to allow for maintaining different temperature set point at different days of the week in addition to

[36] Duct losses can account for more than 30 percent of energy consumption for space conditioning, so ductless heating and cooling systems prevent energy losses that can occur via ductwork (*http://energy.gov/energysaver/ductless-mini-split-air-conditioners*).

at different times of day. For this SNOPR, DOE proposes to continue to include thermostat and controls requirements, as recommended by the MH working group. In addition, DOE proposes to include the updated requirements of ''different days of the week,'' consistent with the 2021 IECC.

DOE requests comment on DOE's interpretation of R403.1 and the proposed updates to the thermostat and controls requirements. In addition, DOE requests comments on whether there are any of the 2021 IECC updates relevant to manufactured housing that should be considered as part of this rulemaking.

c. Proposed § 460.203 Service Hot Water

Consistent with the June 2016 NOPR, DOE proposes to require in § 460.203(a) that manufacturers install service water heating systems according to the service water heating system manufacturer's installation instructions. As proposed, § 460.203 would apply to any service water heating system installed by a manufacturer. In addition, § 460.203 would require manufacturers to provide maintenance instructions for the service water heating system with the manufactured home. These requirements would promote the correct installation and maintenance of service water heating equipment and help to ensure that such equipment performs at its intended level of efficiency.

Further, DOE proposes that § 460.203(b) would require any automatic and manual controls, temperature sensors, and pumps associated with service water heating systems to be similarly accessible. This requirement would ensure that homeowners would have adequate control over service water heating equipment in order to achieve the intended level of efficiency contemplated in 10 CFR part 460. This proposal was consistent with the recommendation of the MH working group. Term Sheet, No. 107 at p. 1.

DOE also proposes specifications for heated water circulation systems in § 460.203(c) based on section R403.5.1.1 of the 2015 and 2021 IECC. The specifications proposed included: (1) Requiring heated water circulation systems be provided with a circulation pump, and that the system return pipe be a dedicated return pipe or cold water supply pipe; (2) prohibiting gravity and thermosyphon circulation systems; (3) requiring that controls for heated water circulation system pumps identify a demand for hot water within the home when starting the pump; and (4) requiring the controls to automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water.

Finally, DOE also proposes that all hot water pipes outside conditioned space be required to be insulated to at least *R*-3, and that all hot water pipes from a water heater to a distribution manifold be required to be insulated to at least *R*-3. These requirements are consistent with the recommendations of the MH working group. Term Sheet, No. 107 at p. 6.

The following paragraphs discuss comments DOE received regarding the service hot water requirements proposed in the June 2016 NOPR, and any other corresponding proposed changes to the June 2016 NOPR requirements based on comments received, or updates to the 2021 IECC.

NEEA recommended that pipe insulation be required on the hot water main branch and locations where the insulation is not in direct contact with the pipe or underfloor. (NEEA, No. 190 at p. 3) WSU Energy Program recommended that all hot water pipes be insulated. (WSU Energy Program, Public Meeting Transcript, No. 148 at p. 63) Taking the opposite viewpoint, Cavco commented that there is minimal to no energy savings from insulating pipes inside the conditioned space. (Cavco, Public Meeting Transcript, No. 148 at p. 66)

DOE's proposal of requiring a minimum *R*-value for all hot water pipes outside conditioned space, and from a service hot water system to a distribution manifold, was based on the 2015 IECC, and is consistent with the 2021 IECC. Term Sheet, No. 107 at p. 6. Therefore, DOE continues to propose the hot water pipe insulation requirement from the June 2016 NOPR. DOE notes that its energy conservation standards do not prohibit manufacturers from employing additional insulation beyond DOE's requirements.

DOE also reviewed the updates to sections R403.5 of the 2021 IECC (relative to the 2015 IECC reviewed by the MH Working Group) as it relates to service hot water systems. DOE notes that section R403.5 is no longer identified as ''mandatory'' in the 2021 IECC. Similar to R403.1 of the 2021 IECC, DOE's understanding of this update is that no technical changes were intended, rather the removal of the label ''mandatory'' was only to make the IECC more understandable and easier to use because the label ''mandatory'' was not used consistently in the IECC. Therefore, DOE preliminarily concludes this update is not a substantive change. In addition, DOE observed the additional requirement that the controls for circulating hot water system shall limit the temperature of the water entering the cold water piping to not greater than 104 °F (40 °C). For this SNOPR, DOE proposes to continue to include service hot water systems requirements, as recommended by the MH working group. In addition, DOE understands that the temperature limitation is not directly applicable to manufactured homes and therefore DOE is not proposing to incorporate in this SNOPR.

DOE requests comment on DOE's interpretation of R403.5 and the proposed updates to the service hot water requirements. In addition, DOE requests comments on whether there are any of the 2021 IECC updates relevant to manufactured housing that should be considered as part of this rulemaking. Specifically, DOE requests comment on whether the circulating hot water system temperature limit should be included as a requirement.

d. Proposed § 460.204 Mechanical Ventilation Fan Efficacy

DOE proposes mechanical ventilation fan efficacy requirements in proposed Table 460.204 based on Table R403.6.2 of the 2021 IECC, which provides requirements for mechanical ventilation system fan efficacy.

DOE received one comment on the June 2016 NOPR regarding mechanical fan efficacy. NEEA commented that the fan efficacy requirement is not as high as it could be, especially with bathroom utility fans, but did not provide a suggested efficacy level. (NEEA, Public Meeting Transcript, No. 148 at p. 64) The mechanical efficacy requirements being proposed in this SNOPR are based on the 2021 IECC. However, DOE emphasizes that it is proposing energy conservation standards established as minimum standards. The requirements as proposed would not prohibit manufacturers from employing more efficient measures.

DOE also reviewed the updates to section R403.6 of the 2021 IECC (relative to the 2015 IECC reviewed by the MH Working Group) as it relates to mechanical ventilation. The 2021 IECC includes new mandatory requirements for IECC climate zones 7 and 8, where dwelling units must be provided with a heat or energy recovery ventilation, and the system must be balanced with a minimum sensible heat recovery efficiency of 65 percent at 32 °F (0 °C) at a flow greater than or equal to the design flow. Further, Table R403.6.2 of 2021 IECC updates the mechanical fan efficacy requirements to include new minimum efficacy requirements for heat recovery ventilators (HRV) and energy recovery ventilators (ERV), and air

handlers that are integrated to tested and listed HVAC equipment, in addition to more stringent minimum efficacy requirements for in-line supply or exhaust fans, other exhaust fans (with separate requirements for fans having a minimum airflow rate of <90 CFM and ≥90 CFM). Finally, DOE notes that the 2021 IECC no longer includes the requirement that where mechanical ventilation fans are integral to tested and listed HVAC equipment, they shall be powered by an electronically commutated motor.

As discussed in section III.E.2.b, ERV and HRV fans can be applicable to manufactured housing. DOE notes that per the 2021 IECC, these requirements would only be applicable to homes in IECC climate zones 7 and 8, which would translate to manufactured homes in HUD zone 3 only, and about 8 percent shipments within the HUD zone. At a primary cost of $1,500 (based on the analysis performed in support of the BECP [37]), the incremental cost for single-section manufactured homes would be as high as $6,159 (see Table I.3 for the purchase price increase). Mandatory requirements for ERV and HRV were not considered by the MH working group and DOE has not yet determined whether this requirement would be cost-effective in manufactured homes.

Regarding the updates to minimum efficacy requirements, this SNOPR proposes to include all requirements except the efficacy requirements for air handlers that are integrated to tested and listed HVAC equipment. This SNOPR is not proposing requirements for appliances and equipment that are regulated pursuant to the statutory scheme in EPCA. Further, DOE proposes to remove the requirement that mechanical fans that are integral to HVAC equipment must be powered by an electronically commutated motor, in line with the 2021 IECC. DOE is also clarifying that the mechanical ventilation fan efficacy requirements would not apply to furnace fans, which are regulated under EPCA.[38] To the extent that a mechanical ventilation fan that is integral to tested and listed HVAC equipment is a furnace fan as defined in 10 CFR 430.2, the furnace fan would be excluded from the proposed efficiency and motor requirements in § 460.204.

In this SNOPR, DOE is also considering energy efficiency measures to reduce uncontrolled air infiltration and air exchange associated with leaks in the air distribution ductwork for the central heating and cooling system, as well as measures that would reduce the energy consumption of mechanical ventilation equipment that is required in the HUD Code.[39] The proposal considers a continuously-operated whole-house exhaust fan. Alternate ventilation approaches include a central fan integrated supply system (in which outdoor air is supplied into the return side of the central heating and cooling system air handler fan by negative pressure whenever the central fan operates for heating/cooling or ventilation); and a heat-recovery ventilation (HRV) system, which is required for certain (colder) climate zones in the 2021 IECC. Various operating schedules could be considered for each type of ventilation equipment.

In addition, DOE is considering measures to mitigate potential adverse impacts to indoor air quality that could arise from the proposal. Considerations include signage for ventilation controls related to energy efficiency, informing the manufactured homeowner of the benefits to indoor air quality of using the system (reinforcing HUD encouragement to operate it whenever the home is occupied per 24 CFR 3280.103(b)(6)), as well as measures that would mitigate indoor air quality impacts per other current ventilation standards (*e.g.,* ASHRAE Standard 62.2, Ventilation and Acceptable Indoor Air Quality in Residential Buildings). In accordance with the Section 413(b)(2) of EISA, such measures are being considered to take into consideration the design and factory construction techniques of manufactured homes and provide for alternative practices that result in net estimated energy consumption equal to or less than the specified standards, and to address previous comments received regarding potential impacts to indoor air quality.

DOE requests comment on the proposal to include the 2021 IECC fan efficacy standard requirements. DOE requests comment on whether any of the fan efficacy requirements are not applicable to manufactured homes.

DOE requests comment on whether the HRV and ERV provisions under 2021 IECC for site-built homes are applicable to manufactured homes and whether they would be cost-effective. Specifically, DOE requests comment on costs for the HRV and ERV requirements as it applies to manufactured homes in all climate zones.

DOE requests comment on the above ventilation strategies, including (but not limited to) cost, performance, noise, and any other important attributes that DOE should consider, including those related to mitigation measures. While the alternate ventilation approaches are not integrated into the analysis presented as part of this proposal, DOE is giving serious consideration as to whether it should incorporate one or more of these options as part of its final rule based on any additional data and public comments it receives.

e. Proposed § 460.205 Equipment Sizing

Consistent with the June 2016 NOPR, DOE proposes specifications for equipment sizing in § 460.205 of the regulatory text, based on section R403.7 of the 2015 and 2021 IECC, which sets forth specifications on the appropriate sizing of heating and cooling equipment within a manufactured home. This section of the 2015 and 2021 IECC requires the use of ACCA Manual S to select appropriately sized heating and cooling equipment based on building loads calculated using ACCA Manual J. The MH working group recommended the inclusion of this specification in the proposed rule. Term Sheet, No. 107 at p. 1.

DOE received several comments on the June 2016 NOPR regarding equipment sizing. ACCA commented that while HVAC manufacturers are producing highly efficient products that exceed DOE's regulatory demands, DOE does not require MH manufacturers to follow the minimum installation design standards that HVAC manufacturers recommend. ACCA asserted that as a result, HVAC systems are significantly less efficient and have shorter lifespans due to incorrect installation. (ACCA, No. 159 at p. 1) ACCA also commented that if DOE educated and incentivized homeowners to demand HVAC systems be installed to industry recommended standards by trained technicians, DOE could promote energy savings. (ACCA, No. 159 at p. 1) WSU Energy Program stated that DOE should consider including regulations regarding the installation of HVAC equipment. (WSU Energy Program, Public Meeting Transcript, No. 148 at p. 116)

DOE acknowledges that installation can affect the efficiency of HVAC

[37] Taylor, Zachary T. Residential Heat Recovery Ventilation. United States. *https://doi.org/10.2172/1488935*.

[38] ''Furnace fan'' is defined as an electrically-powered device used in a consumer product for the purpose of circulating air through ductwork. 10 CFR 430.2.

[39] Based on the HUD requirement for equipment that can provide at least 0.035 cubic feet per minute (cfm) per square foot of floor area (or hourly average equivalent) and a minimum airflow of 50 cfm, HUD requires airflow of at least 50 cfm for any unit up to 1429 square feet, *i.e.,* for all single-wide MH, and 55 cfm for a typical 1570 square foot double-wide unit.

equipment and that HVAC equipment may be installed after a home is manufactured (*i.e.,* at the point of installation). As previously discussed, this rulemaking addresses energy efficiency standards for manufactured housing. To the extent that issues arise in the installation of HVAC equipment by the manufacturer related to proper sizing, § 460.205 addresses such concerns. In addition, HUD provisions in subpart H of 24 CFR part 3280 provide installation requirements for heating, cooling, and fuel burning systems.

DOE did not receive any other comments regarding equipment sizing. In addition, section R403.7 of the 2021 IECC provides no updates to the equipment sizing and efficiency rating requirements.

4. Remaining Comments Regarding the Energy Conservation Standard Requirements

DOE also received numerous other comments that were not specific to the preceding sections or that could not be placed in only one of the preceding sections. Advanced Energy commented that, given the negative health effects of carbon monoxide exposure, carbon monoxide detection should be added to the proposed rule, similar to section 915 of the 2015 International Building Code. (Advanced Energy, No. 189 at p. 1) EISA provides DOE with the authority to regulate energy conservation in manufactured housing. (42 U.S.C. 17071(a)) Because the installation of a carbon monoxide detector is a health and safety matter as opposed to an energy conservation matter, DOE has not proposed this requirement in the SNOPR.

ACC FSC stated that air-permeable insulation without the proper vapor retarder will cause condensation problems and that reducing air leakage and increasing insulation in homes will increase the possibility of condensation unless the proper materials are specified. (ACC FSC, No. 186 at p. 1) DOE is not proposing specifications for condensation control and vapor retarders because condensation control is not an energy conservation measure. The HUD Code, however, includes specifications for condensation control and installation of vapor retarders at 24 CFR 3280.504. DOE's proposed energy conservation standard would not prevent manufacturers from meeting the condensation and vapor retarder requirements established by HUD. This SNOPR, if made final, would not prevent or impede manufacturers from selecting construction materials, assembly methods, and designs that prevent the concerns raised by ACC FSC.

VEIC stated that high-tier and middle-tier efficiency standards for HVAC, domestic hot water, lighting, and appliances should be included as requirements for certification. (VEIC, No. 187 at p. 2) NEEA commented that DOE should include the following energy savings elements in future revisions to the energy conservation standard: Lighting, appliances, domestic hot water efficiency, and HVAC efficiency. (NEEA, No. 190 at p. 4) ACEEE noted that section R404.1 of the 2015 IECC requires that 75 percent of lighting be high-efficacy lamps. It commented that this yields significant additional cost-effective savings over the federal lighting standards. ACEEE urged DOE to include this provision in the standard. (ACEEE, No. 178 at p. 2)

DOE is not proposing energy conservation standards for HVAC, water heaters, lighting, and appliances. As discussed, the energy efficiency of those products is specifically governed by the comprehensive Appliance Standards program established under EPCA. (42 U.S.C. 6291–6317) However, manufacturers would not be prohibited from installing more efficient products and appliances, as long as the energy conservation standards are met. DOE also invites parties interested in energy conservation standards for appliances to comment on the rulemakings associated with those products.[40]

VEIC stated that the proposed rule should include requirements for insulation and air barrier installation training, quality assurance oversight, commissioning, and field performance testing. (VEIC, No. 187 at p. 2) As discussed, EISA directs DOE to establish energy conservation standards for manufactured housing. While DOE is proposing regulations, DOE's Building America Solution Center[41] provides training materials for construction generally, including on topics applicable to manufactured homes. In terms of enforcement and performance testing, DOE will address compliance and enforcement provisions in a separate rulemaking.

Modular Lifestyles and VEIC both offered comments regarding the benefits of zero energy homes. VEIC commented that an alternative to manufactured homes is to replace them with zero energy modular homes. (VEIC, No. 187 at p. 2). Modular Lifestyle gave information regarding their NetZero manufactured home, built in Ojai, California. (Modular Lifestyle, No. 141 at p. 2) DOE acknowledges that there are homes in the market that are already at the top end of energy efficiency. This SNOPR proposes minimum energy efficiency requirements applicable to all manufactured homes, and nothing in this SNOPR would prohibit manufacturers from producing models that exceed these requirements.

WECC stated that the manufactured home's crawl area temperature is warmer than outside ambient temperature during winter, and if the ambient air temperature is used for calculations, then the associated savings are overestimated. (WECC, No. 150 at p. 2) The manufactured homes modeled in the energy simulations in the analyses conducted for the June 2016 NOPR and in this SNOPR are modeled with a vented crawl space below the floors. Thus, the floors are not exposed to ambient air, but to air temperatures within the vented crawlspace (which fall between the ambient outdoor air temperature and the conditioned indoor air temperature); this prevents the energy savings from being overestimated.

### *F. Crosswalk of Standards With the HUD Code*

DOE compared the energy conservation standards proposed in this SNOPR to the construction and safety standards for manufactured homes established by HUD to confirm that compliance with the proposed requirements would not prohibit a manufacturer from complying with the HUD Code.

Table III.15 lists the energy conservation standards and discusses their relationship to similar requirements contained in the HUD Code.

[40] *http://energy.gov/eere/buildings/standards-and-test-procedures.*

[41] *https://basc.pnnl.gov/.*

TABLE III.15—CROSSWALK OF SNOPR STANDARDS WITH THE HUD CODE

| DOE SNOPR (10 CFR part 460) | HUD Code (24 CFR part 3280) | Notes |
|---|---|---|
| Section 460.101 would establish three climate zones, in line with HUD, delineated by state boundaries. The DOE SNOPR proposes different $U_o$ performance requirements for single- and multi-section homes. | Section 3280.506 establishes three zones delineated by state boundaries. The HUD Code establishes one standard for homes of all sizes within a zone. | |
| Section 460.102(a) would establish building thermal envelope prescriptive and performance compliance requirements. | Section 3280.506 establishes a performance approach. | Both DOE and HUD performance requirements are based on maximum Uo requirement per zone for the building thermal envelope. DOE, however, would establish separate Uo requirements per climate zone for single- and multi-section homes, whereas HUD only establishes one Uo requirement, regardless of home size, per zone. |
| Section 460.102(b) would set forth the prescriptive option for compliance with the building thermal envelope requirements. | Section 3280.506 establishes a performance approach only. | The Battelle method is used to determine performance standards (in terms of *Uo*) from prescriptive standards. The DOE proposed performance standards would be prescribed in § 460.102(c)(1). |
| Section 460.102(b)(2) would establish a minimum truss heel height. | No corresponding requirement. | |
| Section 460.102(b)(3) would establish an acceptable batt and blanket insulation combination for compliance with the floor insulation requirement in climate zone 3. | No corresponding requirement. | |
| Section 460.102(b)(4) would identify certain skylights not subject to SHGC requirements. | No corresponding requirements. | |
| Section 460.102(b)(5) would establish *U*-factor alternatives for the *R*-value requirements under section 460.102(b)(1). | No corresponding requirements. | |
| Section 460.102(c)(1) would establish maximum building thermal envelope $U_o$ requirements. | Section 3280.506(a) establishes maximum building thermal envelope $U_o$ requirements by zone. | DOE's proposed maximum building thermal envelope $U_o$ requirements are lower than the corresponding maximum $U_o$ requirements under § 3280.506(a). Compliance with the DOE proposed $U_o$ requirements achieve compliance with the $U_o$ requirements under the HUD Code. |
| Section 460.102(c)(2) would establish maximum area-weighted vertical fenestration *U*-factor requirements in climate zones 2 and 3. | No corresponding requirements. | |
| Section 460.102(c)(3) would establish maximum area-weighted average skylight *U*-factor requirements in climate zones 2 and 3. | No corresponding requirements. | |
| Section 460.102(c)(4) would authorize windows, skylights and doors containing more than 50 percent glazing by area to satisfy the SHGC requirements of § 460.102(a) on the basis of an area-weighted average. | No corresponding requirements. | |
| Section 460.102(e)(1) would establish a method of determining $U_o$ using the Overall *U*-values and Heating/Cooling Loads—Manufactured Homes, or the Battelle method. | Section 3280.508(a) and (b) reference the Overall *U*-values and Heating/Cooling Loads—Manufactured Homes, or the Battelle method. | |
| Section 460.103 would require insulating materials to be installed according to the manufacturer installation instructions and the prescriptive requirements of Table 460.103. | No corresponding requirements. | |
| Section 460.103 would establish requirements for the installation of batt, blanket, loose fill, and sprayed insulation materials. | No corresponding requirements. | |
| Section 460.104 would require manufactured homes to be sealed against air leakage at all joints, seams, and penetrations associated with the building thermal envelope in accordance with the manufacturer's installation instructions and the requirements set forth in Table 460.104. | Section 3280.505 establishes air sealing requirements of building thermal envelope penetrations and joints. | |

TABLE III.15—CROSSWALK OF SNOPR STANDARDS WITH THE HUD CODE—Continued

| DOE SNOPR (10 CFR part 460) | HUD Code (24 CFR part 3280) | Notes |
|---|---|---|
| Section 460.201(a) would require each manufactured home to be equipped with a duct system that must be sealed to limit total air leakage to less than or equal to 4 cfm per 100 square feet of floor area and specify that building framing cavities are not to be used as ducts or plenums when directly connected to mechanical systems. | No corresponding requirements. | |
| Section 460.202(a) would require at least one thermostat to be provided for each separate heating and cooling system installed by the manufacturer. | Section 3280.707(e) requires that each space heating, cooling, or combination heating and cooling system be provided with at least one adjustable automatic control for regulation of living space temperature. | Both DOE's proposed rule and the HUD Code require the installation of at least one thermostat that is capable of maintaining zone temperatures. |
| Section 460.202(b) would require that installed thermostats controlling the primary heating or cooling system be capable of maintaining different set temperatures at different times of day and different days of the week. | No corresponding requirements. | |
| Section 460.202(c) would require heat pumps with supplementary electric resistance heat to be provided with controls that, except during defrost, prevent supplemental heat operation when the pump compressor can meet the heating load. | Section 3280.714(a)(1)(ii) requires heat pumps to be certified to comply with ARI Standard 210/240–89, heat pumps with supplemental electrical resistance heat to be sized to provide by compression at least 60 percent of the calculated annual heating requirements of the manufactured home, and that a control be provided and set to prevent operation of supplemental electrical resistance heat at outdoor temperatures above 40 °F. | Both DOE's proposed rule and the HUD Code require heat pumps with supplemental electric resistance heat to prevent supplemental heat operation when the heat pump compressor can meet the heating load of the manufactured home. |
| Section 460.203(a) would establish requirements for the installation of service hot water systems. | No corresponding requirements. | |
| Section 460.203(b) would require any automatic and manual controls, temperature sensors, pumps associated with service hot water systems to be accessible. | No corresponding requirement. | |
| Section 460.203(c) would establish requirements for heated water circulation systems. | No corresponding requirements. | |
| Section 460.203(d) would establish requirement for the insulation of hot water pipes. | No corresponding requirements. | |
| Section 460.204 would establish requirements for mechanical ventilation system fan efficacy. | Section 3280.103(b) establishes whole-house ventilation requirements. | HUD requirements at § 3280.103(b) do not overlap with DOE's proposed rule. DOE's proposed requirement is for fan electrical efficiency, while HUD requirements specify minimum and maximum air flow rates. |
| Section 460.205 would establish requirements for heating and cooling equipment sizing. | No corresponding requirements. | |

## IV. Discussion and Results of the Economic Impact and Energy Savings

### *A. Economic Impacts on Individual Purchasers of Manufactured Homes*

DOE conducts LCC and PBP analyses to evaluate the economic impacts on individual consumers of energy conservation standards for manufactured housing. The effect of new or amended energy conservation standards on individual consumers usually involves a reduction in operating cost and an increase in purchase cost. DOE uses the following two metrics to measure consumer impacts:

- The LCC is the total consumer expense of a manufactured home over the life of that home, consisting of total installed cost plus total operating costs. To compute the total operating costs, DOE discounts future operating costs to the time of purchase and sums them over the lifetime of the product (or another specified period).
- The PBP is the estimated amount of time (in years) it takes consumers to recover the increased purchase cost (including installation) of a more-efficient manufactured home through lower operating costs.

For the June 2016 NOPR, DOE used the LCC and PBP analyses developed during the MH working group negotiations to inform the development of the proposed rule based on the economic impacts on individual purchasers of manufactured homes. The LCC of a manufactured home refers to the total homeowner expense over the life of the manufactured home (30 years), consisting of purchase expenses (*e.g.,* loan or cash purchase) and operating costs (*e.g.,* energy costs). To compute the operating costs, DOE discounted future operating costs to the time of purchase and summed them over the 30-year lifetime of the home used for the purpose of analysis in this rulemaking. A 10-year LCC was also calculated to reflect the cost of ownership over the tenure of the first homebuyer. DOE calculated the PBP by dividing the incremental increase in purchase cost by the reduction in

average annual operating costs that would result from this rule.

In the June 2016 NOPR, the LCC analysis demonstrated that increased purchase prices due to the proposed energy efficiency measures (''EEMs'') would be offset by the benefits manufactured home homeowners would experience via operating cost savings. DOE evaluated these projected impacts on individual manufactured home homeowners by analyzing the potential impacts to LCC, energy savings, and purchase price of manufactured homes under the proposed rule. For the purpose of the June 2016 NOPR economic analysis, DOE compared the purchase price and LCC for manufactured homes built in accordance with the proposed rule relative to a baseline manufactured home built in compliance with the minimum requirements of the HUD Code. Specifically, DOE performed energy simulations on manufactured homes located in 19 geographically diverse locations across the United States, accounting for five common heating fuel/system types and two typical industry sizes of manufactured homes (single-section and double-section manufactured homes).[42] DOE received a number of comments regarding several aspects of the economic impacts on individual consumers described in the June 2016 NOPR. DOE also received comments pertaining to the methodology and assumptions used in the economic analysis conducted for the June 2016 NOPR. For this SNOPR, DOE conducted similar LCC and PBP analyses for the requirements as proposed in this document. The changes made from the analyses performed for the June 2016 NOPR are discussed in the following sections, including any changes that DOE has made in the methodology and assumptions, along with a discussion of the submitted comments.

1. Discussion of Comments and Analysis Updates

a. Analysis Period for LCC

In the June 2016 NOPR, DOE analyzed a 10-year LCC to represent the first ownership period and cost of the first homebuyer, and a 30-year LCC to represent the lifetime of the manufactured home and associated costs, which would represent the total costs and benefits for all occupants over the life of the manufactured home. The 30-year lifetime was selected as a typical length that EEMs last in the aggregate. The monetary value of these EEMs was considered to depreciate linearly over the 30-year lifetime. At the end of this 30-year lifetime, the EEMs would have no monetary value.

DOE received comments on the June 2016 NOPR discussing the time period that a consumer owns a manufactured home. COBA commented that in its experience, consumers generally stay in their manufactured home 2 to 3 years. (COBA, Public Meeting Transcript, No. 148 at p. 97) SBRA also stated that on average, the first homeowner of a manufactured home sells their home within 7 years of purchase and is unlikely to realize any incremental value from the EEMs. (SBRA, No. 163 at p. 2) MHI stated that manufactured homes change ownership within 7 to 10 years. (MHI, No. 182 at p. 6)

DOE appreciates the information provided by these organizations regarding the potential ownership period of manufactured homes. DOE researched the ownership period of manufactured home homeowners and found that a study by the Consumer Financial Protection Bureau (CFPB) indicated an average ownership period of 13 years. This study also found that based on 50,000 manufactured homesites in 161 communities in 2014, manufactured homes resided in their community for an average of 40 years, an indication of manufactured home lifetime.[43] A 2012 study conducted by Foremost Insurance Group found that 40 percent of manufactured home homeowners do not anticipate ever selling their manufactured home.[44] Furthermore, a 2021 manufactured housing industry overview fact sheet developed by MHI suggests that 62 percent of all homeowners anticipate living in their homes for more than 10 years and that 38 percent of homeowners don't anticipate ever selling their home.[45] Therefore, there are many factors that may affect the duration of time that a manufactured home remains under a given homeowner. For purposes of this analysis, DOE continues to rely on the 10-year time period as a reasonable representation of the ownership period of the first homebuyer for the overall manufactured housing market as it is between the values suggested COBA and SBRA and the high value reported by the CFPB, and consistent with the value reported by MHI.

Additionally, due to concerns about incremental cost for low-income families, DOE is proposing the Tier 1 standard for manufactured homes with manufacturer's retail list price of $55,000 or less. As discussed below, manufactured homes complying with the Tier 1 standard would have an average PBP of 3.7 and 3.5 years for single-section and multi-section homes, respectively, while achieving a positive cash flow in the first year of occupancy. Further discussion of these concerns is addressed in section IV.A.1.i.

MHARR commented that the PBP found in the analysis will be longer once the costs of compliance are included and passed onto the consumer (MHARR, No. 154 at p. 27). As discussed above, DOE is not addressing a compliance, certification, and enforcement program in this rulemaking, but may do so in the future. However, DOE will consider comments and information on compliance and enforcement matters provided by stakeholders, including costs.

DOE also received comments regarding the longer term LCC period (*i.e.,* 30 years). MHI expressed concern with using a 30-year time period to justify energy efficiency investments because most manufactured homes change ownership within 7 to 10 years and may not see the savings from the increased upfront cost. (MHI, No. 182 at p. 6) GWU stated that the 10-year LCC analysis represents a much more accurate reflection of the manufactured housing consumers' benefits rather than the 30-year LCC analysis because the 30-year analysis is not representative of the timespan that owners live in manufactured homes. (GWU, No. 175 at pp. 3–4) Conversely, VEIC commented that the 30-year LCC should be used instead of the 10-year LCC analysis because the 30 years is more representative of the timespan in which the manufactured home will be in service. (VEIC, No. 187 at p. 2)

EISA directs DOE to base the standards on the most recent version of the IECC considering, among other things, the total life-cycle construction and operating costs. (42 U.S.C. 17071(b)(1)) As such, DOE is considering the total life-cycle costs and operating costs of the standards proposed in this document.

As discussed previously, DOE determined that the average tenure of a manufactured homeowner is 13 years, and the lifetime of a home can average 40 years. However, DOE understands that there are constraints in the secondary market for manufactured

[42] Double-section manufactured homes were used to represent all multi-section homes. Double-section manufactured homes have the largest market share by shipments (about 98 percent) of all multi-section homes.

[43] Consumer Financial Protection Bureau. Manufactured-housing Consumer Finance in the United States. September 2014.

[44] Foremost Insurance Group. 2012 Mobile Home Market Facts.

[45] Manufactured Housing Institute. 2021 Manufactured Housing Facts: Industry Overview.

homes, as outlined in the 2014 CFPB report. Accordingly, DOE performed the 10-year analysis to determine the economic impacts of the proposed rule on the first homeowner. DOE also performed the 30-year analysis to determine the economic impacts, as well as the cumulative benefits over the lifetime of the manufactured home. In this SNOPR, DOE continues to use both the 10-year and 30-year LCC analyses from the June 2016 NOPR.

DOE received several comments regarding PBP results relating to the LCC and homeownership periods. In the June 2016 NOPR, DOE reported national average PBP values of 7.1 years for single-section homes and 6.9 for multi-section homes. MHARR stated that the projected consumer PBP is longer than consumers live in a particular manufactured home. (MHARR, No. 154 at p. 27) AGA and APGA commented that the PBP should be less than 5 years for the resident to truly gain a benefit. (AGA & APGA, No. 172 at p. 1)

As previously stated, a study by the CFPB indicated that the average ownership period of 13 years. DOE assumes a 10-year ownership period for the first owner of the manufactured home in its 10-year LCC analysis. Table IV.17, Table IV.10, and Table IV.11 provide the results for DOE's simple PBP analysis for the rule as proposed in this SNOPR, broken out by tiers and climate zone for single-section and multi-section homes. These resulting simple PBPs indicate that the first owner of a Tier 1 manufactured home would gain a net benefit and would realize positive net savings from the proposed energy standards. The simple PBP of a Tier 1 standard manufactured home is 3.7 years for single-section and 3.5 years for multi-section homes, and the simple PBP of a Tier 2 standard manufactured home is 10.9 years for single-section and 10.6 years for multi-section. Although the simple PBPs for Tier 2 homes exceed the 10-year ownership period for the first owner, they still fall within the 13-year average ownership period. In addition, DOE considered a sensitivity analysis for an alternative insulation requirement for Tier 2 homes, R–21, wherein the PBP is 8.5 for single-section and 8.9 years for multi-section homes.

b. Interest Rate

In the June 2016 NOPR LCC analysis, DOE estimated an interest rate of 5 percent for consumers using real estate loans, 9 percent for consumers using chattel (personal property) loans, and 5 percent for consumers paying for the manufactured home outright with cash. These were conservative figures based on ranges provided by the MH working group. According to data provided by the MH working group, real estate loans typically have interest rates ranging from approximately 4.0 to 4.3 percent and chattel loans typically have interest rates ranging from 6.3 percent to 9.5 percent. EERE–2009–BT–BC–0021–0074. In the June 2016 NOPR analysis, DOE used a 5-percent real estate loan interest rate and a 9-percent chattel loan interest rate as a conservative estimate.

Regarding the different interest rates used for the LCC analysis, GWU commented that interest rates on chattel loans range from 7 percent to 13 percent and that DOE's use of 9 percent may be too low. (GWU, No. 175 at p. 5) DOE conducted research on interest rates for real estate and chattel loans to confirm the discount rates determined by the MH working group. DOE's research showed that chattel loans often range from 0.5 to 5 percent more than real estate loans according to a CFPB study released in September 2014.[46] This difference between real estate loan and chattel loan rates supports DOE's assumptions from the June 2016 NOPR, which used a chattel loan rate of 9 percent, which is 4 percent higher than the real estate loan interest rate of 5 percent. DOE did not find a more recent CFPB study of the same. For the SNOPR LCC analysis, DOE maintains the interest rate values used in the June 2016 NOPR.

c. Discount Rate for LCC

In the June 2016 NOPR LCC analysis, DOE used a discount rate of 5 percent for consumers using real estate loans, 9 percent for consumers using chattel (personal property) loans, and 5 percent for consumers paying for the manufactured home outright with cash. The discount rate was set equal to the loan interest rate because this rate represents a primary ''investment'' available to a homeowner (that is, the homeowner can pay down the loan early, avoiding interest payments at the rate associated with the loan). Therefore, DOE discounted cash flows in the LCC analysis using a discount rate equal to this alternative investment rate (the loan interest rate).

Regarding the discount rates used in the June 2016 NOPR LCC analysis, ACEEE supported the June 2016 NOPR, stating that an LCC analysis using a discount rate similar to the rate low-income homeowners would pay for a mortgage should be reasonable. (ACEEE, No. 178 at p. 3) Alternatively, GWU stated it also conducted its own LCC analysis based on discount rates of 5, 9, and 13 percent. GWU's LCC results using these inputs found that consumers in certain cities are anticipated to bear net costs and summing the percentage of national shipments of each of these cities would result in 28.5 percent of all shipments of single-section manufactured homes and 35.1 percent of all shipments of multi-section manufactured homes anticipated to bear net costs. GWU stated that these studies indicate that DOE's proposed rule does not fit the statutory cost-effectiveness requirement given in EISA. (GWU, No. 175 at p. 6)

DOE appreciates ACEEE's comment supporting the June 2016 NOPR LCC discount rates. Regarding the LCC analysis conducted by GWU, DOE's understanding is that the results were based on a discount rate of 13 percent, which was the upper bound of the 7-percent to 13-percent range of chattel rates GWU presented and is higher than DOE's estimate of 9 percent. In addition, it is not clear what analysis period GWU relied on (DOE uses 10 and 30 years). However, the discount rate values used by GWU diminish the value of the benefits of reduced energy use relative to the values used in the June 2016 NOPR. As described previously, the June 2016 NOPR analysis was based on the real estate and chattel loan rates of 5 percent and 9 percent, respectively, as well as a 30-year analysis period reflecting the lifespan of a manufactured home. For the reasons already discussed, for this SNOPR, DOE continues to find these values more appropriate than those used by GWU. Using the discount rates equal to the corresponding interest rate, in this SNOPR, DOE's 30-year and 10-year analyses indicate that the national average results show positive LCC savings compared to the baseline.[47]

d. Down Payment and Loan Term

In the June 2016 NOPR, DOE assumed a down payment of 20 percent for both real estate and chattel loans. DOE received several comments on the June 2016 NOPR suggesting alternatives to the down payment assumptions used in the NOPR.

[46] Consumer Financial Protection Bureau. Manufactured-housing Consumer Finance in the United States. September 2014. Available at: *https://www.consumerfinance.gov/data-research/research-reports/manufactured-housing-consumeR-finance-in-the-U-s/.*

[47] For Tier 1 standards, all cities (except for Miami in the 10-year analysis) indicate positive LCC savings. For Tier 2 standards, all cities in HUD climate zones 1 and 2 indicate positive LCC savings for 30-year and 10-year analyses. Certain cities in HUD climate zone 3, however, do not indicate positive LCC savings. Details can be found in chapter 8 and 9 of the SNOPR TSD.

MHI and COBA indicated that DOE may be overestimating the LCC savings by using a down payment assumption of 20 percent for chattel loans. According to MHI and COBA, chattel loan down payments are rarely 20 percent, and a more common range representative of the industry is 5–10 percent. (MHI, No. 182 at p. 6; COBA, Public Meeting Transcript, No. 148 at p. 92) After researching the matter, DOE tentatively agrees that a lower down payment assumption (relative to the June 2016 NOPR) is appropriate. MHI's ''Trends and Information About the Manufactured Housing Industry 2016'' indicates that down payments for all loans used for manufactured homes range from 10 to 20 percent.[48] Although some commenters stated that a 5 percent down payment can occur, a 5 percent down payment is below the lower boundary of what lenders accept for a chattel loan, as reported by MHI. DOE also notes that the impact of down payment percentage is limited in an LCC calculation because reductions in upfront down payment costs are mostly offset by increases in monthly principal and interest payments (and vice versa). Based on the comments and new information on typical down payments for chattel loans, for the SNOPR, DOE assumes a down payment of 10 percent for chattel loans and maintained a down payment of 20 percent for real estate loans.

Regarding the loan term for chattel loans, MHI recommended that DOE use an estimate of 10 to 15 years. (MHI, Public Meeting Transcript, No. 148 at p. 91; MHI, No. 182 at p. 7) In the June 2016 NOPR, DOE used a 15-year loan term for chattel loans for the LCC analysis based on suggestions from the MH working group. DOE's NOPR estimate of 15 years falls within the range recommended by MHI. No comments were received suggesting that the 15-year assumption was inappropriate. For the SNOPR, DOE maintains the chattel loan term of 15 years.

e. Resale Value of Manufactured Homes

DOE received several comments on the June 2016 NOPR regarding the resale value of manufactured homes and how that may affect the LCC analysis. GWU commented that DOE's LCC analysis did not take into account the difficulty in recouping high upfront costs via resale. It stated that secondhand buyers have difficulty obtaining adequate financing for resold manufactured homes because lenders often charge higher interest rates on used manufactured homes. (GWU, No. 175 at p. 3) Lippert Components and MHI also expressed concern that it will be unlikely that first-time homeowners will be able to recapture the cost of EEMs in the event of a resale. (Lippert Components, No. 152 at p. 1; MHI, No. 182 at p. 6) Conversely, WSU Energy Program commented that resale values of manufactured homes with energy efficiency measures are often higher than those without these measures. (WSU Energy Program, Public Meeting Transcript, No. 148 at p. 93) Further, WSU Energy Program stated that this higher resale value of the manufactured home must be considered when calculating payback period. (WSU Energy Program, Public Meeting Transcript, No. 148 at p. 93)

For the SNOPR, as with the June 2016 NOPR, DOE conducted the LCC analysis based on the total homeowner expense over the life of the manufactured home and operating costs. A 30-year lifetime was selected as a typical length that energy efficiency measures last in a manufactured home. In addition, DOE also performed a 10-year LCC analysis, which represents the cost of ownership over the tenure of the first homeowner. Both analyses assume that the incremental cost of the DOE-compliant home depreciates on a linear basis over the 30-year lifetime. Therefore, DOE's analysis assumes that not all of the incremental cost of EEMs is recouped at resale.

Increases in resale value can offset upfront costs when considering life cycle costs over a period of time. However, the PBP metric is a ''simple PBP'' based on dividing the incremental increase in purchase cost by the average annual savings in operating costs that would result from the rule. Therefore, resale value is not included in the PBP calculation. DOE maintains this methodology in the SNOPR, as the resale value of the home does not have any direct input into the calculation of a simple PBP.

f. Tax Rate

Property taxes vary widely within and among states. In the June 2016 NOPR, DOE assumed a property tax rate of 0.9 percent, which was agreed upon by the MH working group. DOE also separately determined the median tax rate and found that the 2013 American Housing (AHS) Survey for manufactured homes reported a $10 per $1,000 in home value, indicating a 1-percent tax rate.[49] The later AHS reports (2015, 2017 or 2019) did not provide an updated estimate; thus, DOE continues to consider the estimate from the 2013 AHS Survey. The reported AHS estimate substantiated the MH working group recommendation.

DOE received one comment regarding the property tax rate used in the June 2016 NOPR. COBA commented that the property tax rate data used in the June 2016 NOPR analysis for the LCC was incorrect, without further elaborating on a better estimate. (COBA, No. 158 at p. 3) As no alternative estimates were offered, for this SNOPR, DOE continues to assume a property tax rate of 0.9 percent based on the MH working group recommendation and the AHS Survey.

g. Incremental Cost

In the June 2016 NOPR, DOE arrived at the incremental cost to the consumer by calculating the difference in the EEM costs of DOE-compliant and minimally compliant HUD homes. These incremental costs correspond to the purchase prices seen by the homeowner, and thus account for manufacturer and retail markups. DOE used incremental component costs (retail costs) provided and agreed to by the MH working group. ASRAC Cost Analysis Data, EERE–2009–BT–BC–0021–0091.

Regarding the incremental costs, MHARR stated that the cost figures used for the June 2016 NOPR analysis were obtained primarily from large manufacturers, and therefore the cost is understated for smaller manufacturers who do not benefit from large volume supply orders. MHARR conducted a study based on higher supply costs associated with small manufacturers and concluded that the price increase will be $4,600 and $5,825 above the HUD Code for single- and multi-section manufactured homes, respectively. (MHARR, No. 154 at p. 30; MHARR, No. 143 at p. 4)

Conversely, NEEA and VEIC stated that the incremental costs found and used in DOE's analysis may be overstating the cost increases. NEEA commented that the real-world incremental costs would be lower than DOE estimates. NEEA cited data (from the Pacific Northwest region) that shows current incremental purchase prices for ENERGY STAR homes (which NEEA stated are more stringent than the proposed rule) are between $2,000 and $3,000 more than a manufactured home minimally compliant with the HUD

[48] Manufactured Housing Institute, Trends and Information about the Manufactured Housing Industry 2016. *https://www.manufacturedhousing.org/wp-content/uploads/2016/11/1836temp.pdf.*

[49] U.S. Census Bureau, American Housing Survey, 2013 *http://www.census.gov/programs-surveys/ahs/data.2013.html.*

Code. NEEA indicated that DOE's incremental costs do not incorporate economies of scale, good engineering practice, and improved technology, which would result (once all MH manufacturers meet the DOE standard) in much lower realized incremental costs. (NEEA, No. 190 at p. 4; NEEA, Public Meeting Transcript, No. 148 at p.72) VEIC commented that the estimated incremental costs are inflated. (VEIC, No. 187 at p. 2)

In the June 2016 NOPR, DOE used incremental component costs provided and agreed to by the MH working group. MHI stated that these costs represent small, medium, and large manufacturers, commenting that for the cost analysis conducted by MHI and SBRA, small, medium, and large manufacturers were all consulted during the MH working group process. (MHI, Public Meeting Transcript, No. 148 at p. 85) DOE analyzed MHARR's incremental costs and identified a number of differences in the inputs between DOE's and MHARR's calculations. Specifically, DOE found that for certain components, such as exterior floor insulation, MHARR's incremental costs were based on baseline thermal requirements that were different than what was used by the MH Working Group. In another case, MHARR's calculations also included costs for exterior doors. However, DOE expects no incremental cost associated with doors because the insulation level (*U*-factor) for a baseline home was assumed to already meet the *U*-factor requirement in the proposed rule. In addition, MHARR did not provide the sources for the costs identified. In summary, MHARR's comment provided insufficient detail to verify that the incremental costs corresponded to the same home construction parameters and the same EEMs as DOE used in its analysis. As a result of these inconsistencies, DOE did not revise the component incremental costs from the June 2016 NOPR based on the data provided by MHARR. Furthermore, DOE reviewed the 2020 RSMeans construction cost estimating software to corroborate the cost data used in the June 2016 NOPR and concluded that the estimates provided by the MH working group continues to remain mostly relevant. Therefore, for the SNOPR, DOE proposes to maintain the component incremental costs used in the June 2016 NOPR and established by the MH working group, as these values are representative of manufacturers of all sizes.

Regarding incremental cost impacts on retailers, MHARR stated that smaller retailers will feel the full brunt of the increased costs. (MHARR, No. 143 at p. 4) DOE notes that retailers will experience increased costs. However, DOE's analysis anticipates that the full incremental cost of the EEMs necessary to comply with the SNOPR will be passed through to the consumer, bypassing the manufacturer and retailer. While DOE agrees retailers (both large and small) will see higher prices when purchasing manufactured homes from MH manufacturers, these same manufactured homes will be sold at a correspondingly higher price to the consumer.

For this SNOPR, DOE updated the total incremental costs for the tiered standards—*i.e.,* Tier 1 energy efficiency requirements based on the set of energy efficiency measures that provide energy savings under at a set upfront incremental purchase price (*i.e.,* approximately $750) and Tier 2 energy efficiency requirements that specify more stringent building thermal envelope requirements. The proposed tiered approach addresses concerns regarding potential impacts of first-cost increases on price-sensitive, low-income purchasers of manufactured homes. Table I.1 and Table I.2 provide the updated total incremental costs, depending on the tiered standard being analyzed. Table I.3 provides the updated total incremental costs under the proposed untiered standard.

h. Reliability of the LCC

DOE received a comment regarding the overall reliability of the LCC analysis to capture potential savings related to the rulemaking. MHI stated that the LCC analysis is too uncertain to justify the projected upfront purchase price, and specifically stated that small errors in energy cost escalation rates can turn a long-term benefit into a long-term loss. (MHI, No. 182 at p. 6)

DOE understands that there may be uncertainties regarding the future prices of energy. In the June 2016 NOPR, the energy cost inputs used in the LCC analysis, including energy prices and their escalation rates, were based on the *Annual Energy Outlook 2015* (*AEO 2015*) and Short-Term Energy Outlook studies, prepared by the U.S. Energy Information Administration (''EIA''). The *AEO* presents long-term annual projections of energy supply, demand, and prices. The projections, focused on U.S. energy markets, are based on results from EIA's National Energy Modeling System (''NEMS''). NEMS enables EIA to make projections under internally consistent sets of assumptions. DOE believes these studies are the best current and future estimates of energy prices and escalation rates and uses these studies in support of all of its energy conservation standard rulemakings. In the SNOPR, DOE proposes to maintain the same source for establishing energy prices and escalation rates and updated the *AEO* source to the latest version at the time of the SNOPR analysis, which was *AEO 2020.*

Lastly, EISA requires that DOE establish energy conservation standards for manufactured housing with consideration of the cost-effectiveness as related to the purchase price and total life-cycle construction and operating costs generally. (42 U.S.C. 17071(b)(1)) As such, the LCC analysis in this SNOPR addresses this requirement by incorporating the total homeowner expense over the life of the manufactured home, consisting of purchase expenses (*e.g.,* loan or cash purchase) and operating costs (*e.g.,* energy costs).

i. Affordability

Consistent with concerns raised in DOE's consultation with HUD, commenters raised concerns regarding the impact of energy conservation standards on the affordability of manufactured homes. DOE received comments from organizations that stated that manufactured homes are an important aspect of unsubsidized affordable housing across the country and that the average income of a manufactured homeowner is half the national average. Commenters indicated that any changes in the cost of manufactured homes will price some consumers out of homeownership and expressed concern that the proposed rule did not offer any assistance to offset the predicted cost increase and resulting decrease in manufactured home production. (Pleasant Valley Homes, No. 153 at p. 1; Skyline Corporation, No. 165 at p. 1; Clayton Homes, No. 185 at p. 2; MHIM, No. 155 at p. 1; NMMHA, No. 157 at p. 1; MHIA, No. 161 at p. 1; MHISC, No. 191 at p. 1; OMHA, No. 166 at p. 1; MMHA, No. 170 at p. 2; AMHA, No. 173 at p. 2; PMHA, No. 164 at p. 1; Commodore Corporation, No. 195 at p. 1) Cavco commented that the industry must maintain affordability in order to increase home ownership and stated that if the cost to produce a home increases, the costs will be passed onto the consumer. They also expressed concern that the manufactured housing market has extended too much credit to homeowners. (Cavco, Public Meeting Transcript, No. 148 at p. 87) SBRA suggested that DOE analyze how this standard affects home ownership affordability for consumers once the

rule is implemented. (SBRA, Public Meeting Transcript, No. 148 at p. 19)

DOE recognizes the role of manufactured homes in the U.S. housing market and their ability to provide affordable housing. As already discussed in section II.B.4 and in several other sections in this document, concern over the initial first-cost impacts that the June 2016 NOPR energy efficiency requirements would have on low-income buyers led DOE to contemplate cost-effective approaches that would also mitigate first-cost impacts for purchasers at the lower end of the manufactured home price range, and to examine and propose the tiered-approach presented in this SNOPR. In consideration of the first-cost impacts and cost-effectiveness for low-income purchasers, the tiered approach would subject those manufactured homes with a manufacturer's retail list price of $55,000 or less (*i.e.,* Tier 1) to a set of energy efficiency measures that have an upfront incremental purchase price of approximately $750 (for a single-section home). Table I.1 provides the updated total incremental costs. Under the proposed tiered approach, manufactured homes with a manufacturer's retail list price greater than $55,000 (in real 2019$) (*i.e.,* Tier 2) would generally be subject to the same set of requirements as applicable to Tier 1 manufactured homes, but with more stringent *U*-factor and *R*-value requirements. The Tier 2 energy conservation standards are the same as those that would apply to all manufactured homes under the proposed untiered standard.

While both proposals presented in the SNOPR (*i.e.,* the tiered approach and the single set of standards) would result in incremental cost increases for manufactured homes that may be passed to the consumer, the full incremental cost is not paid by the consumer on the purchase date because consumers (particularly low-income consumers) purchase manufactured homes with a down payment and other financing (either through a personal property loan, often referred to as a ''chattel loan,'' or a real estate loan). A consumer would typically only pay a 10-percent down payment for a chattel loan, and the remainder of the incremental cost increase passed to the consumer would be spread through increases in payments throughout the loan term (15 to 30 years). DOE's current LCC analysis tentatively finds that these loan payment increases would be offset by the energy cost savings for all cities except one (with San Francisco being the only exception) in the tiered standards, providing a net benefit and cost-effectiveness to the consumer. San Francisco represents 1.2 percent of all single-section home shipments (Tier 1 + Tier 2) analyzed. Further, DOE notes that Tier 2 single-section homes would be a portion (approximately 0.5 percent) of the all single-section homes shipments. While increases in purchase price as a result of either proposed standard are tentatively projected to be offset by the benefits derived from the projected energy cost savings, DOE requests comment regarding the cost-effectiveness of both options to inform its final decision.

Relating to the general affordability of manufactured homes, SBRA recommended that DOE work with the industry in establishing an economic basis for energy efficiency standard development that would serve as the benchmark for setting requirements that improve home affordability. (SBRA, No. 163 at p. 2) DOE used the LCC and PBP analyses developed during the MH working group negotiations to inform the development of the proposed rule based on the economic impacts on individual purchasers of manufactured homes. As such, DOE has initially concluded that the national economic benefits outweigh the increased purchase price, indicating that under both proposals the applicable energy conservation standards would improve the economic status of consumers in most regions relative to the status quo.

DOE also received comments regarding affordability and the cost-effective provision of EISA. MHARR stated that the cost-effective provision of EISA must be applied to ensure that energy standards do not result in purchase price increases that would impair manufactured housing affordability, availability, or accessibility. (MHARR, No. 154 at p. 24) DOE performed an LCC analysis in this SNOPR that calculated the total homeowner expense over a period of 30 years, consisting of purchase expenses (*e.g.,* chattel loan, conventional mortgage or cash purchase) and operating costs (*e.g.,* energy costs). The national average results of the LCC analysis show positive LCC savings for a 30-year analysis period and annual energy cost savings for the homeowner in each climate zone (see section IV.A.2). The cost-benefit analysis shows that the increased purchase cost to the consumer would be offset by energy cost savings. In addition to these results, DOE presents a sensitivity analysis for an alternative insulation requirement for Tier 2 homes in zones 2 and 3, which would increase life-cycle cost savings and decrease the simple PBP for affected homes relative to the R–20+5 insulation requirement based on the 2021 IECC.

Regarding the availability of manufactured homes, for this SNOPR (and in the June 2016 NOPR), DOE addressed the reduction of shipments based on the projected increase in home upfront costs using a price elasticity of demand (price elasticity) calculation. Price elasticity is an economic concept that describes the change of the quantity demanded in response to a change in price. Price elasticity is typically represented as a ratio of the percentage change in quantity relative to a percentage change in price. Sections IV.C.1.a and IV.C.1.b provide more details on how DOE incorporated price elasticity in the shipments analysis and the magnitude of people who do not buy because they are price-sensitive.

DOE also received many comments from groups concerned with a potential 3–10 percent increase in purchase price of manufactured home as a result of the proposed standards. Because of the affordable housing crisis in the U.S., they stated that the final rule should avoid any increases in cost for consumers by providing programs for consumers to obtain financing or aid in purchasing their homes. These commenters urged DOE to improve energy efficiency while preserving affordability and to work with lenders, federal regulators, and HUD to mitigate the upfront costs of these regulations before the rule is finalized. (Pleasant Valley Homes, No. 153 at p. 1; Skyline Corporation, No. 165 at p. 1; Clayton Homes, No. 185 at p. 2; MHIM, No. 155 at p. 2; NMMHA, No. 157 at p. 2; MHIA, No. 161 at p. 2; MHISC, No. 191 at p. 1; OMHA, No. 166 at p. 1; MMHA, No. 10 at p. 2; AMHA, No. 173 at p. 2; PMHA, No. 164 at p. 2; Form Letter, No. 192 at p. 1; COBA, No. 158 at p. 5; Commodore Corporation, No. 195 at p. 2)

Specifically, several commenters recommended that DOE also consult with the CFPB and Federal Housing Finance Agency (''FHFA'') to ensure that there is enough flexibility in qualified mortgage regulations to permit an increase in debt-to-income ratios when paired with reductions in energy costs. (Better Homes, No. 168 at p. 1, Next Step, No. 174 at p. 2, MHI, No. 182 at p. 7) Next Step also commented that DOE should collaborate with HUD, FHFA, and the U. S. Department of Agriculture (''USDA'') to ensure flexibility in underwriting guidelines. (Next Step, No. 174 p. 2) WECC recommended the use of low-income weatherization funds, Property Assessed Clean Energy (PACE) financing, carbon offsets, and Environmental Protection

Agency's (EPA) Home Performance with ENERGY STAR program to help offset the increased price. (WECC, No. 150 at p. 3) Lastly, MHI recommended that DOE work with HUD, USDA, U.S. Department of Veterans Affairs (VA), and the U.S. Department of the Treasury to explore whether manufactured homes that meet DOE's standard would be eligible for ENERGY STAR tax credits, thereby providing more incentive and relief to the consumers despite the increase in purchase price. (MHI, No. 182 at p. 7)

DOE appreciates these comments and understands that affordability and cost-effectiveness for low-income purchasers is an important issue when discussing manufactured housing. However, DOE's authority for this rulemaking is limited to energy conservation standards for manufactured housing. While DOE has considered the cost-effectiveness and affordability concerns described throughout this document, matters related to financing, tax credits, or other financial incentives or assistance for manufactured housing are outside the scope of this rulemaking, which is being conducted only to establish an energy conservation standard for manufactured housing. As already discussed, to help mitigate the potential impacts of a price increase, DOE is proposing a tiered proposal in this SNOPR that would establish a pricing tier to address those manufactured homes likely to be purchased by more price-sensitive consumers, and by limiting the impact to the first-cost for Tier 1 manufactured homes. The Tier 1 energy conservation standards, as proposed, are estimated to result in a 0.7–1.4 percent increase in first cost, depending on climate zone. These incremental costs would be offset by the energy savings provided from the energy efficiency measures and the incremental increase in upfront costs and monthly loan payments is recouped in less than one year. Furthermore, the PBP associated with the Tier 1 standard is only 3.7 years for single-section homes and 3.5 years for multi-section homes.

Along with consumer financing, Next Step and Lippert Components both recommended the implementation of consumer education for potential homeowners, to properly inform them of the benefits and paybacks of more efficient homes. (Next Step, No. 174 at p. 3; Lippert Components, No. 152 at p. 1) Next Step also commented that it currently has a system called Manufactured Housing Done Right, which connects comprehensive homebuyer education with responsible financing so potential buyers can purchase ENERGY STAR compliant, factory-built homes. (Next Step, No. 174 at p. 1) DOE agrees that consumer education is important aspect to ensuring the effectiveness of any standards that may be adopted. To this end, DOE has described this proposed regulation in detail in this document and can respond to questions from the public. While a consumer education program is not an element of the statutory mandate of EISA, DOE provides a number of resources to educate homeowners on the energy efficiency, including those applicable to manufactured housing.[50]

MHI also commented that DOE must engage with HUD to revisit the economic assumptions and revise consumer impact estimates. MHI stated that any new regulation must avoid reducing the availability of affordable homeownership options. (MHI, No. 182 at p. 1) GWU stated that DOE should revisit the effect of the proposed standards on the Federal Government's goal to increase the availability of affordable housing. (GWU, No. 175 at p. 12) In this SNOPR, DOE has reviewed the economic assumptions relied upon in the June 2016 NOPR and made changes where appropriate. As explained, DOE is proposing a tiered approach in this SNOPR in response to concerns raised regarding affordability and cost-effectiveness. In addition, DOE changed the down payment assumptions from 20 percent to 10 percent for chattel loans (see section IV.A.1.d). Furthermore, DOE made updates to energy costs, energy escalation rates, and inflation rates based on the updates to *AEO 2020.* DOE also updated the distribution of heating type in the 19 cities analyzed in the LCC analysis based on the 2019 MHI shipments. DOE discusses its price elasticity calculation in the shipment analysis (see section IV.C.1.a).

j. Priced-Out Consumers

DOE received comments on the June 2016 NOPR indicating concern that the proposed rule's incremental cost relative to the existing HUD Code would eliminate the ability of some low-income consumers to obtain the financing necessary to purchase a new home, resulting in consumers being priced out of the manufactured housing market. (Advocacy, No. 177 at p. 3; GWU, No. 175 at p. 8; Form Letter, No. 192 at p. 1; Pleasant Valley Homes, No. 153 at p. 1; Skyline Corporation, No. 165 at p. 1; Clayton Homes, No. 185 at p. 2; MHIM, No. 155 at p. 1; NMMHA, No. 157 at p. 1; MHIA, No. 161 at p. 1; MHISC, No. 191 at p. 1; OMHA, No. 166 at p. 1; MMHA, No. 170 at p. 2; AMHA, No. 173 at p. 2; PMHA, No. 164 at p. 1; MHI, No. 182 at p. 1, SBRA, No. 163 at p. 2; MHARR, No. 143 at p. 4) Specifically, MHARR cited a 2014 National Association of Home Builders (''NAHB'') study that MHARR asserted indicates that more than 1 million households would be priced out of the market for a single-unit manufactured home and over an additional one million households would be priced out of the multi-section market as a result of DOE's proposed standards. (MHARR, No. 154 at p. 25) Similarly, AMHA stated a recent NAHB study indicated each $1,000 increase over the median-home price results in 200,000 prospective households being excluded from the market. (AMHA, No. 173 at p. 1)

As discussed in section IV.A.1.i, DOE is proposing a tiered approach for which energy conservation standards for manufactured home with a manufacturer's retail list price of $55,000 or less would be established, in part, on a defined upfront manufacturer's retail list price increase (*i.e.,* $750). DOE is proposing this approach in consideration of concerns related to potential adverse impacts on price-sensitive, low-income purchasers of manufactured homes from the imposition of energy conservation standards. Under the tiered proposal, incremental cost increases for Tier 1 manufactured homes would be 0.7–1.4 percent.

DOE reviewed the 2014 NAHB study referenced by MHARR and AMHA and found the values cited by MHARR and AMHA from that study are not representative of the manufactured housing market's prospective buyers. The NAHB study estimates the reduction in buyers assuming all American households intend to buy a home. The NAHB study stated that an increase of $1,000 would exclude approximately 350,000 households from purchasing a single-section home, and the same $1,000 would exclude 315,000 households from purchasing a multi-section home. MHARR extrapolated that the incremental costs of the standards would exclude more than 1 million households from each of the single- and multi-unit markets.

Rather than analyzing all American households, DOE's estimate in this SNOPR calculates the number of households no longer able to purchase a manufactured home from the pool of households planning to purchase a manufactured home (which is much smaller than the total number of American households). As a result of

[50] *E.g., https://www.energy.gov/energysaver/types-homes/energy-efficient-manufactured-homes.*

the tiered standards, first, DOE considered that a percentage of manufactured homes placed/sold would shift to less stringent standards, *i.e.,* a percentage of homes from Tier 2 would shift to Tier 1. The inclusion of this shift in the market is to more accurately estimate energy savings (and other downstream results) if the proposed tiered standard approach is finalized. Second, with the inclusion of this shift, DOE estimates the SNOPR would result in a loss in demand and availability because of the increase in upfront home price for each tier. Therefore, DOE includes in the analysis a price elasticity of demand, which is typically represented as a ratio of the percentage change in quantity relative to a percentage change in price. DOE considered a price elasticity of −0.48 based on a study by Marshall and Marsh.[51] Further discussion on the substitution effect is provided in section IV.C.1.a and price elasticity is provided in section IV.A.1.j.

Accordingly, DOE estimates the SNOPR would result in a loss in demand and availability of about 53,329 homes (single section and multi-section combined) for the tiered standard using a price elasticity of demand of −0.48 for the analysis period (2023–2052). Out of the 53,329 homes in the tiered standard, the majority of the reduction is in Tier 2 (93 percent) vs. Tier 1 (7 percent). Within Tier 1, DOE estimates a 0.52 percent reduction (essentially no reduction) in availability due to Tier 1 standards for low income purchasers. Given that low-income consumers generally purchase lower priced manufactured homes, DOE concludes that low-income consumers would not be priced out by the Tier 1 standards proposed in this SNOPR.

As a sensitivity, DOE also considered a price elasticity of demand of −2.4 instead of −0.48. Further discussion on this sensitivity is provided in Section 10.4 of Chapter 10 of the TSD. Table IV.1 provides a summary of the change in shipments from baseline for the tiered standards for a price elasticity of −0.48 and −2.4.

TABLE IV.1—CHANGE IN SHIPMENTS COMPARED TO BASELINE, −0.48 AND −2.4 PRICE ELASTICITY

| | Change in shipments, −0.48 price elasticity | | | Change in shipments, −2.4 price elasticity | | |
|---|---|---|---|---|---|---|
| | Tier 1 | Tier 2 | Total | Tier 1 | Tier 2 | Total |
| 30-year analysis | (3,693) | (49,636) | (53,329) | (18,375) | (247,692) | (266,067) |
| Annual | (123) | (1,655) | (1,778) | (613) | (8,256) | (8,869) |

In the study published in the Journal of Housing Economics by Marshall and Marsh, the authors conclude that national and local programs that cause small price increases in manufactured housing units (*e.g.,* increasing energy efficiency) will not necessarily deter thousands of low-income families from purchasing manufactured homes and that such consumers are likely to be willing to accept incrementally higher prices from improvements in energy use and cost efficiency. Specifically, the study states that these consumers are not nearly as price-sensitive because ''the cost of a manufactured home still ranges from 21% to 65% of the cost of a site built home and low- and moderate-income families have few low-cost choices for home ownership.'' [52] Costs provided by a 2021 manufactured housing industry overview fact sheet developed by MHI suggests that in 2019, on average, the average sales price of a manufactured home compared to a new single-family site built home is about 27 percent (without land).[53] There is additional discussion in section IV.c.1.b on the decrease in manufactured housing shipments that results from people who do not buy because they are price-sensitive.

DOE requests comment on the price elasticity values used in DOE's analysis and in the sensitivity analysis as well as any data or research available with respect to the demand sensitivity in the manufactured housing market.

DOE also received comments stating that it was necessary to capture the costs and economic impact associated with the exclusion of some consumers from the manufactured housing market as a result of this standard. (MHARR, Public Meeting Transcript, No. 148 at p. 80; MHARR, No. 154 at p. 29) COBA commented that if a consumer is priced out of the market for manufactured homes, there are no energy savings that the consumer can encounter. (COBA, Public Meeting Transcript, No. 148 at p. 82) Lippert Components stated that it doubted that the benefits of the increases in energy efficiency will outweigh the negative impacts caused by the elimination of choice and reduction of affordability of manufactured homes due to the proposed standards. (Lippert Components, No. 152 at p. 1)

The cost savings estimates for the proposals in this SNOPR are based on manufactured housing sales in response to the incremental increase in housing costs. A discussion of the projected future shipments is provided at section III.C.1.a of this docment.

DOE also received comments regarding the issue of consumers being priced out of the manufactured housing market within specific regions. GWU suggested that DOE specifically consider the distributive economic impact on climate zones 1 and 2, as they account for roughly 40 percent of all manufactured housing shipments. GWU stated that under the standard as proposed in the June 2016 NOPR, climate zones 1 and 2 will bear higher costs from the increased standards, which is especially problematic as these zones have higher poverty rates. GWU recommended that DOE analyze the impact of the proposed rule on low-income consumers in high-poverty regions. (GWU, No. 175 at p. 8)

The energy standards in the proposals presented in this SNOPR would provide benefits in energy savings to the consumer (including those in climate zones 1 and 2) which, over the span of the PBP, would offset the increase in purchase price. Under the tiered proposal, manufactured homes that would be subject to the Tier 1 standards would have a PBP less than 10 years for all climate zones and recoup any additional upfront and monthly payments in less than one year.

k. Other Comments

DOE also received numerous other comments that were not specific to the above sections or could not be placed in only one of the above sections. WECC stated that consumers' trust and confidence must be secured if these higher costs are to be received favorably.

[51] See Marshall, M.I. & Marsh, T.L. Consumer and investment demand for manufactured housing units. *J. Hous. Econ.* 16, 59–71 (2007).

[52] See Marshall, M.I. & Marsh, T.L. Consumer and investment demand for manufactured housing units. *J. Hous. Econ.* 16, 59–71 (2007).

[53] Manufactured Housing Institute. 2021 Manufactured Housing Facts: Industry Overview.

WECC stated that the environment associated with manufactured housing is found to be fraught with deceptive loan practices, which is an issue that needs to be addressed. (WECC, No. 150 at p. 1) NCJC commented that the industry has been noted for predatory sales and lending practices. NCJC commented that DOE's analysis of the rule's economic impact and energy savings demonstrates the benefits of the rule to homebuyers, especially low-income ones. (NCJC, No. 184 at p. 2) DOE appreciates these comments. As noted, EISA directs DOE to establish energy conservation standards for manufactured housing while accounting for certain criteria and considerations. (42 U.S.C. 17071(a)–(b)) Comments regarding loan practices are beyond the scope of this rulemaking.

2. Results

This section provides the tentative results for the projected economic impacts on individuals, including the LCC and PBP. In this SNOPR, DOE has included two options: A two-tiered set of standards and a single untiered standard, as described in section III.E.2.b. DOE also updated all inputs to the LCC and PBP based on the updated AEO 2020. This includes updates to the inflation rates, energy prices, and energy pricing growth rates. DOE adjusted the down payment percentage for personal property (chattel) loans to 10 percent based on comments received on the June 2016 NOPR and maintained a 20 percent down payment for real estate loans. Lastly, the analyses include updates to the fuel type distributions based on 2019 MHI shipments.

Further, as discussed in section I.A, DOE also used different loan parameters for the analysis for the untiered standard and the alternate tiered standard. This is because the Tier 1 and Tier 2 standards each would apply to a portion of all manufactured homes, whereas the untiered standard would apply to all manufactured homes. Specifically, the Tier 1 standard would apply to manufactured homes with a manufacturer's retail list price of $55,000 or less, and would be applicable to price-sensitive, low-income purchasers. Therefore, DOE considered only personal property loans for the Tier 1 standard analysis. For the Tier 2 standard, DOE recalculated the loan percentages such that the sales-weighted Tier 1 and Tier 2 standard loan percentages would equate to the overall loan percentages for the untiered standard. See Table IV.2 for details on the loan parameter percentages used for the analyses.

TABLE IV.2—LOAN PARAMETER PERCENTAGES

| | Personal property (%) | Real estate (%) | Cash (%) |
|---|---|---|---|
| Tier 1 Standard | 100.0 | 0.0 | 0.0 |
| Tier 2 Standard | 39.5 | 20.5 | 40.0 |
| Untiered Standard | 54.6 | 15.4 | 30.0 |

The LCC analysis allowed DOE to analyze the effects of the energy conservation standard on both the individual consumer, as well as the aggregate benefits at the national level. Table IV.3, Table IV.4, and Table IV.5 provide the average purchase price increases to manufactured homes associated with the HUD climate zones, under the proposals. These costs are based on estimates for the increased costs associated with more energy efficient components, as provided by the MH working group. ASRAC Cost Analysis Data, EERE–2009–BT–BC–0021–0091. These costs are discussed in further detail in chapter 5 and chapter 9 of the SNOPR TSD.

TABLE IV.3—NATIONAL AVERAGE MANUFACTURED HOUSING PURCHASE PRICE (AND PERCENTAGE) INCREASES UNDER THE TIER 1 STANDARD

[2020$]

| | Single-section | | Multi-section | |
|---|---|---|---|---|
| | $ | % | $ | % |
| Climate Zone 1 | $629 | 1.2 | $900 | 0.9 |
| Climate Zone 2 | 629 | 1.2 | 900 | 0.9 |
| Climate Zone 3 | 721 | 1.4 | 702 | 0.7 |
| National Average | 663 | 1.2 | 839 | 0.8 |

TABLE IV.4—NATIONAL AVERAGE MANUFACTURED HOUSING PURCHASE PRICE (AND PERCENTAGE) INCREASES UNDER TIER 2 STANDARD

[2020$]

| | Single-section | | Multi-section | |
|---|---|---|---|---|
| | $ | % | $ | % |
| Climate Zone 1 | $2,574 | 4.8 | $4,143 | 4.0 |
| Climate Zone 2 | 4,820 | 9.1 | 6,167 | 5.9 |
| Climate Zone 3 | 4,659 | 8.8 | 5,839 | 5.6 |
| National Average | 3,914 | 7.4 | 5,289 | 5.1 |

TABLE IV.5—NATIONAL AVERAGE MANUFACTURED HOUSING PURCHASE PRICE (AND PERCENTAGE) INCREASES UNDER UNTIERED STANDARD

[2020$]

| | Single-section | | Multi-section | |
|---|---|---|---|---|
| | $ | % | $ | % |
| Climate Zone 1 | $2,574 | 4.8 | $4,143 | 4.0 |
| Climate Zone 2 | 4,820 | 9.1 | 6,167 | 5.9 |
| Climate Zone 3 | 4,659 | 8.8 | 5,839 | 5.6 |
| National Average | 3,914 | 7.4 | 5,289 | 5.1 |

Figure IV.1, Figure IV.2, and Figure IV.3 illustrate the average annual energy cost savings for space heating and air conditioning for the first year of occupation by geographic location under the proposed tiered approach based on the estimated fuel costs provided in chapter 8 of the SNOPR TSD.

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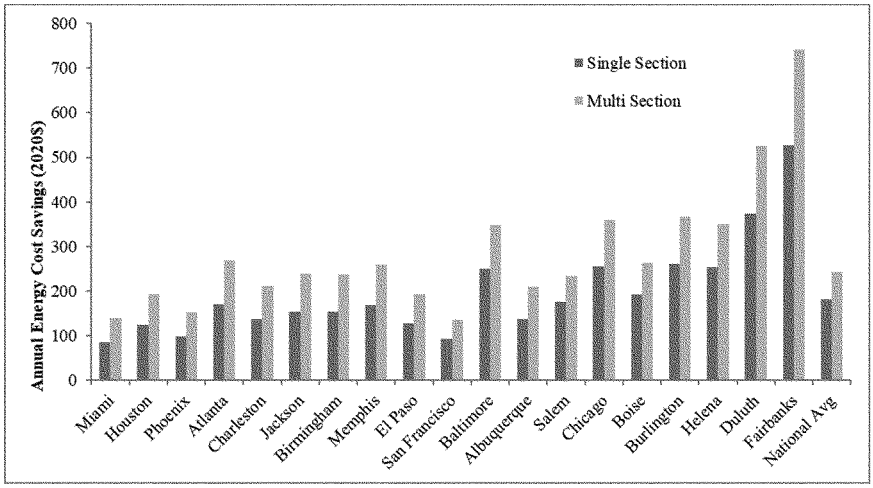


**Figure IV.1: Annual Energy Cost Savings under the Tier 1 Standard**

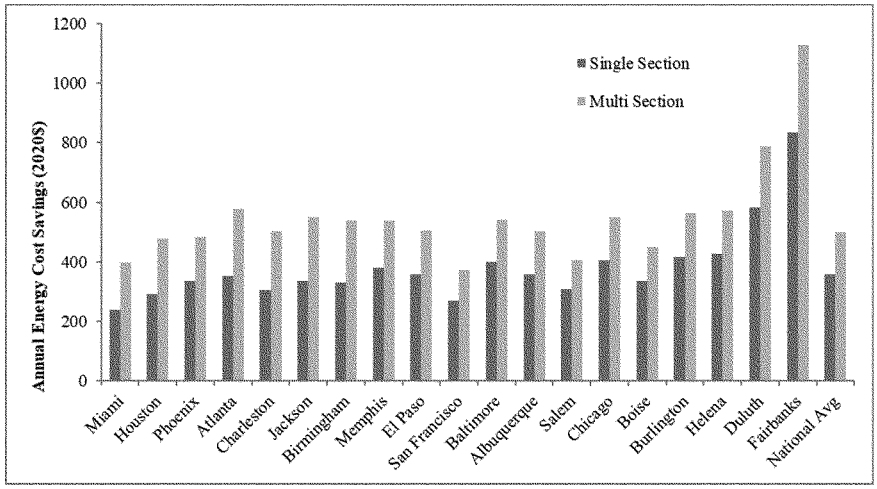


**Figure IV.2: Annual Energy Cost Savings under the Tier 2 Standards**

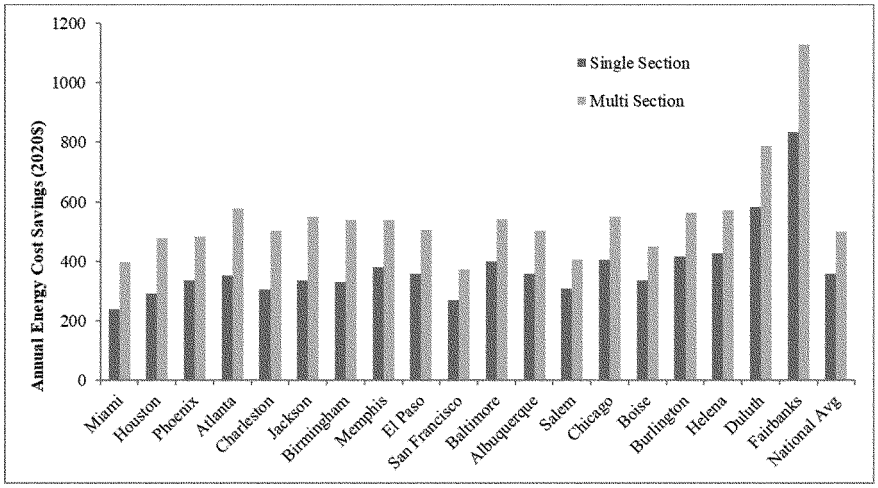


**Figure IV.3: Annual Energy Cost Savings under the Untiered Standards**

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Table IV.6 through Table IV.8 and Figure IV.4 through Figure IV.6 illustrate the average 30-year LCC savings by geographic location (averaged across the five different heating fuel/system types) associated with the proposals for both single-section and multi-section manufactured homes. As discussed in detail in chapter 8 of the SNOPR TSD, the results presented account for LCC savings and impacts over a 30-year period of analysis, including energy cost savings and chattel loans or conventional mortgage payment increases discounted to a present value using the discount rates discussed in chapter 4 of the SNOPR TSD. These tentative results also are based on the costs associated with the proposed energy conservation improvements, as discussed in chapter 5 of the SNOPR TSD.

TABLE IV.6—AVERAGE MANUFACTURED HOME LCC SAVINGS (30 YEARS) UNDER THE TIER 1 STANDARD BY CLIMATE ZONE

[2020$]

| | Single-section | Multi-section |
|---|---|---|
| Climate Zone 1 | $988 | $1,505 |
| Climate Zone 2 | 1,114 | 1,612 |
| Climate Zone 3 | 2,691 | 3,763 |
| National Average | 1,643 | 2,235 |

TABLE IV.7—AVERAGE MANUFACTURED HOME LCC SAVINGS (30 YEARS) UNDER THE TIER 2 STANDARDS BY CLIMATE ZONE

[2020$]

| | Single-section | Multi-section |
|---|---|---|
| Climate Zone 1 | $2,351 | $3,686 |
| Climate Zone 2 | 1,073 | 1,808 |
| Climate Zone 3 | 2,579 | 3,444 |
| National Average | 2,105 | 3,033 |

TABLE IV.8—AVERAGE MANUFACTURED HOME LCC SAVINGS (30 YEARS) UNDER THE UNTIERED STANDARDS BY CLIMATE ZONE

[2020$]

| | Single-section | Multi-section |
|---|---|---|
| Climate Zone 1 | $2,043 | $3,196 |
| Climate Zone 2 | 711 | 1,314 |
| Climate Zone 3 | 2,117 | 2,851 |
| National Average | 1,727 | 2,511 |

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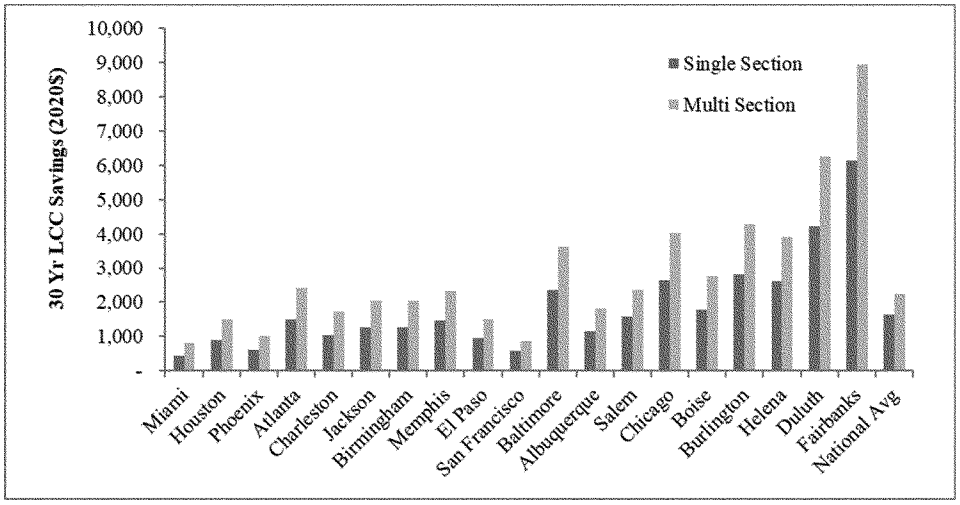


**Figure IV.4: Thirty-Year Lifecycle Cost Savings under the Tier 1 Standard**

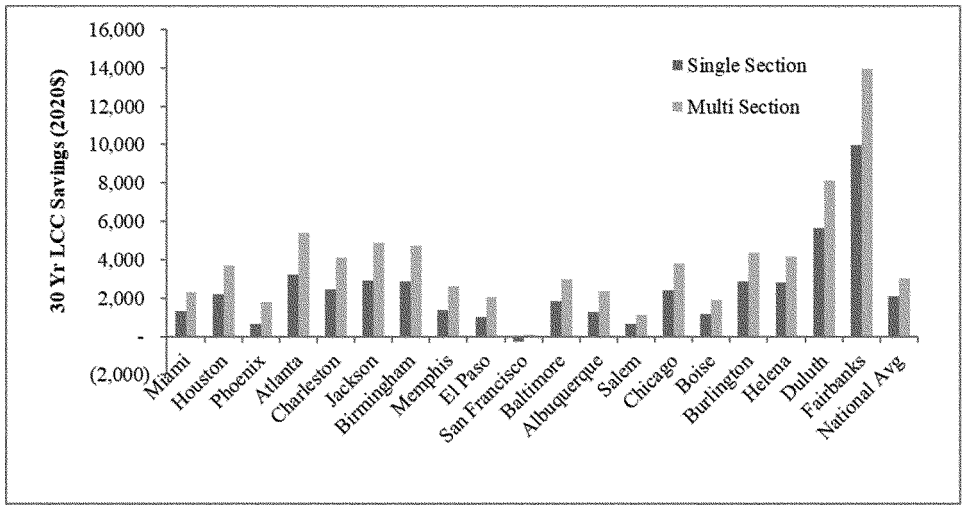


**Figure IV.5: Thirty-Year Lifecycle Cost Savings under the Tier 2 Standards**

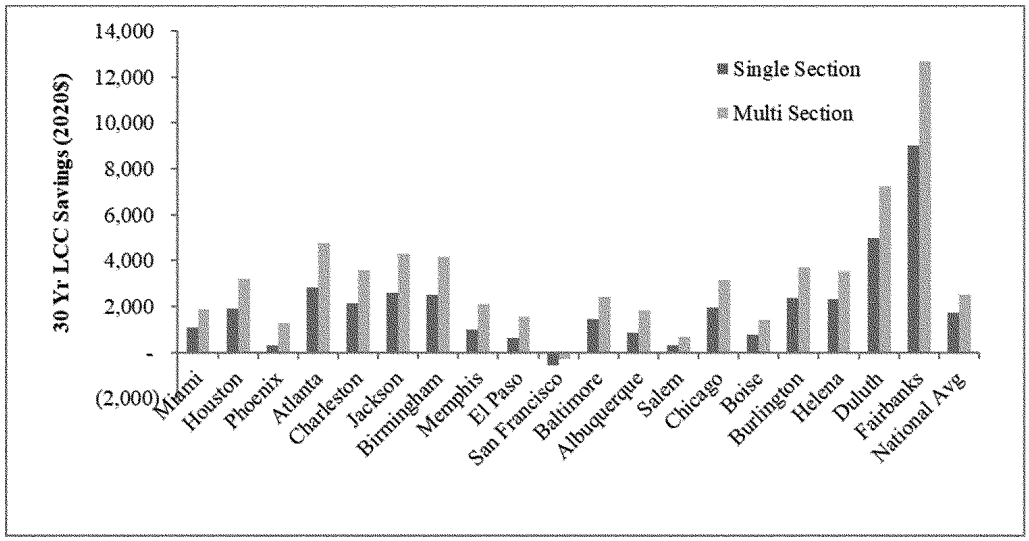


**Figure IV.6: Thirty-Year Lifecycle Cost Savings under the Untiered Standards**

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As shown, the national average savings for the untiered standard and the tiered standards (*i.e.,* Tier 1 and Tier 2) are net positive, though not every geographic region experiences a net savings in the proposed standards (*i.e.,* San Francisco in Climate Zone 2). DOE notes that for the prescriptive method, Tier 2 and Untiered manufactured homes in climate zone 2 (including San Francisco) and climate zone 3 would require a R–20+5 exterior wall insulation to be consistent with the 2021 IECC without modification. The ''+5'' involves using ''continuous insulation,'' which is insulation that runs continuously over structural members and is free of significant thermal bridging. As a sensitivity analysis, DOE considered the impacts on the LCC savings of instead requiring less stringent exterior wall insulation (at R–21 instead of R–20+5) to remove the continuous insulation requirement if complying with the prescriptive requirements presented in Table III.8. At R–20+5, the incremental cost per unit relative to the baseline is $2,500, versus $850 for R–21. DOE considered this alternative insulation requirement for zones 2 and 3 to address potential equity impacts in the regional distribution of benefits and costs and to ensure that each metro area analyzed could experience a positive LCC at Tier 2. Table IV.9 through Table IV.12 present the LCC savings results and Table IV.13 presents the simple payback periods for the sensitivity analysis. Chapter 8 of the TSD presents the same results per city. With this update, all cities, including San Francisco, show positive LCC savings for the 30-year analysis for both the tiered and untiered standards. Prior to the final rule stage, DOE is considering additional analysis to further explore the impacts of R–21 for homes in zones 2 and 3 under Tier 2 and the untiered proposal.

TABLE IV.9—AVERAGE MANUFACTURED HOME LCC SAVINGS (30 YEARS) UNDER THE TIER 2 STANDARDS BY CLIMATE ZONE

[2020$]

| | With R–20+5 wall insulation for climate zones 2 and 3 | | With R–21 wall insulation for climate zones 2 and 3 | |
|---|---|---|---|---|
| | Single-section | Multi-section | Single-section | Multi-section |
| Climate Zone 1 | $2,351 | $3,686 | $2,351 | $3,686 |
| Climate Zone 2 | 1,073 | 1,808 | 2,373 | 3,124 |
| Climate Zone 3 | 2,579 | 3,444 | 3,618 | 4,511 |
| National Average | 2,105 | 3,033 | 2,820 | 3,768 |

TABLE IV.10—AVERAGE MANUFACTURED HOME LCC SAVINGS (30 YEARS) UNDER THE UNTIERED STANDARDS BY CLIMATE ZONE

[2020$]

| | With R–20+5 wall insulation for climate zones 2 and 3 | | With R–21 wall insulation for climate zones 2 and 3 | |
|---|---|---|---|---|
| | Single-section | Multi-section | Single-section | Multi-section |
| Climate Zone 1 | $2,043 | $3,196 | $2,043 | $3,196 |
| Climate Zone 2 | 711 | 1,314 | 2,031 | 2,648 |
| Climate Zone 3 | 2,117 | 2,851 | 3,194 | 3,954 |
| National Average | 1,727 | 2,511 | 2,461 | 3,262 |

TABLE IV.11—AVERAGE MANUFACTURED HOME LCC SAVINGS (10 YEARS) UNDER THE TIER 2 STANDARDS BY CLIMATE ZONE

[2020$]

| | With R–20+5 wall insulation for climate zones 2 and 3 | | With R–21 wall insulation for climate zones 2 and 3 | |
|---|---|---|---|---|
| | Single-section | Multi-section | Single-section | Multi-section |
| Climate Zone 1 | $563 | $862 | $563 | $862 |
| Climate Zone 2 | (496) | (454) | 452 | 501 |
| Climate Zone 3 | 108 | 235 | 949 | 1,086 |
| National Average | 124 | 264 | 675 | 820 |

TABLE IV.12—AVERAGE MANUFACTURED HOME LCC SAVINGS (10 YEARS) UNDER THE UNTIERED STANDARDS BY CLIMATE ZONE

[2020$]

| | With R–20+5 wall insulation for climate zones 2 and 3 | | With R–21 wall insulation for climate zones 2 and 3 | |
|---|---|---|---|---|
| | Single-section | Multi-section | Single-section | Multi-section |
| Climate Zone 1 | $460 | $698 | $460 | $698 |

TABLE IV.12—AVERAGE MANUFACTURED HOME LCC SAVINGS (10 YEARS) UNDER THE UNTIERED STANDARDS—Continued
BY CLIMATE ZONE
[2020$]

| | With R–20+5 wall insulation for climate zones 2 and 3 | | With R–21 wall insulation for climate zones 2 and 3 | |
|---|---|---|---|---|
| | Single-section | Multi-section | Single-section | Multi-section |
| Climate Zone 2 | (645) | (650) | 334 | 337 |
| Climate Zone 3 | (53) | 30 | 822 | 915 |
| National Average | (12) | 77 | 560 | 654 |

TABLE IV.13—AVERAGE MANUFACTURED HOME SIMPLE PAYBACK PERIOD UNDER THE TIER 2/UNTIERED STANDARDS

| | With R–20+5 wall insulation for climate zones 2 and 3 | | With R–21 wall insulation for climate zones 2 and 3 | |
|---|---|---|---|---|
| | Single-section | Multi-section | Single-section | Multi-section |
| Climate Zone 1 | 8.6 | 8.7 | 8.6 | 8.7 |
| Climate Zone 2 | 13.3 | 12.7 | 9.3 | 9.7 |
| Climate Zone 3 | 11.1 | 10.9 | 7.8 | 8.3 |
| National Average | 10.9 | 10.6 | 8.5 | 8.9 |

DOE requests comment on the cost-effectiveness and feasibility of requiring R–20+5 for the exterior wall insulation for climate zone 2 and 3 Tier 2/Untiered manufactured homes. DOE also requests comment on the sensitivity analysis for R–21 that would result in positive LCC savings for all cities.

The estimated LCC impacts under Figure IV.4, Figure IV.5, and Figure IV.6 vary by location for three primary reasons. First, each geographic location analyzed is situated in one of three climate zones and therefore would be subject to different energy conservation requirements. Second, geographic locations within the same climate zone would experience different levels of energy savings. Finally, the level of energy cost savings depends on the type of heating system installed and fuel type used in a manufactured home. As discussed in chapter 8 of the SNOPR TSD, DOE has accounted for regional differences in heating systems and fuel types commonly installed in manufactured housing.

Table IV.14 provides the national average LCC savings and annual energy cost savings associated with the proposals in the SNOPR for space heating and air conditioning (and percent reduction in space heating and cooling costs), both of which are measured against a baseline manufactured home constructed in accordance with the HUD Code. As discussed in further detail in chapter 9 of the SNOPR TSD, each geographic location has been determined to result in LCC savings and energy savings, on average.

TABLE IV.14—NATIONAL AVERAGE PER-HOME COST SAVINGS UNDER THE SNOPR

| | Single-section | Multi-section |
|---|---|---|
| **Tiered Standards** | | |
| Lifecycle Cost Savings (30 Years) | $1,852 | $3,033 |
| Annual Energy Cost Savings (2020$) | 261 | 499 |
| **Untiered Standard** | | |
| Lifecycle Cost Savings (30 Years) | 1,727 | 2,511 |
| Annual Energy Cost Savings (2020$) | 359 | 499 |

Table IV.15 through Table IV.17 and Figure IV.7 through Figure IV.9 illustrate the nationwide average simple payback period (purchase price increase divided by first year energy cost savings) under the SNOPR. The estimated simple payback periods vary by geographic location based on the different climate zone requirements for manufactured housing, geographic climatic differences within climate zones, type of heating system installed, and fuel type used in a manufactured home.

TABLE IV.15—AVERAGE MANUFACTURED HOME SIMPLE PAYBACK PERIOD UNDER THE TIER 1 STANDARD
BY CLIMATE ZONE

| | Single-section | Multi-section |
|---|---|---|
| Climate Zone 1 | 4.8 | 4.6 |
| Climate Zone 2 | 4.5 | 4.5 |

TABLE IV.15—AVERAGE MANUFACTURED HOME SIMPLE PAYBACK PERIOD UNDER THE TIER 1 STANDARD—Continued BY CLIMATE ZONE

| | Single-section | Multi-section |
|---|---|---|
| Climate Zone 3 | 2.8 | 2.1 |
| National Average | 3.7 | 3.5 |

TABLE IV.16—AVERAGE MANUFACTURED HOME SIMPLE PAYBACK PERIOD UNDER TIER 2 STANDARD BY CLIMATE ZONE

| | Single-section | Multi-section |
|---|---|---|
| Climate Zone 1 | 8.6 | 8.7 |
| Climate Zone 2 | 13.3 | 12.7 |
| Climate Zone 3 | 11.1 | 10.9 |
| National Average | 10.9 | 10.6 |

TABLE IV.17—AVERAGE MANUFACTURED HOME SIMPLE PAYBACK PERIOD UNDER UNTIERED STANDARD BY CLIMATE ZONE

| | Single-section | Multi-section |
|---|---|---|
| Climate Zone 1 | 8.6 | 8.7 |
| Climate Zone 2 | 13.3 | 12.7 |
| Climate Zone 3 | 11.1 | 10.9 |
| National Average | 10.9 | 10.6 |

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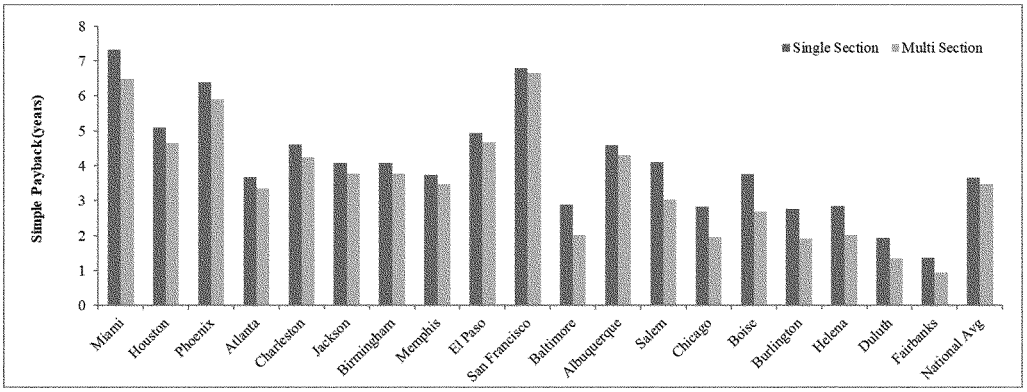


**Figure IV.7: Simple Payback Period Under the Tier 1 Standard**

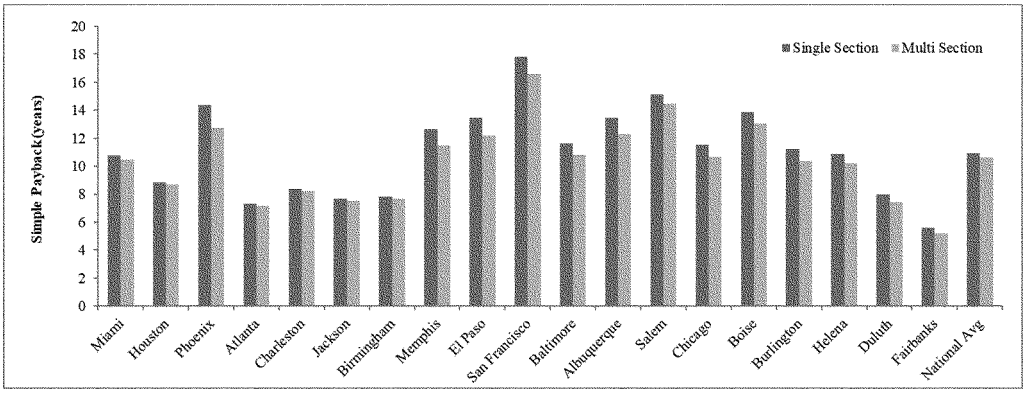


**Figure IV.8: Simple Payback Period Under the Tier 2 Standards**

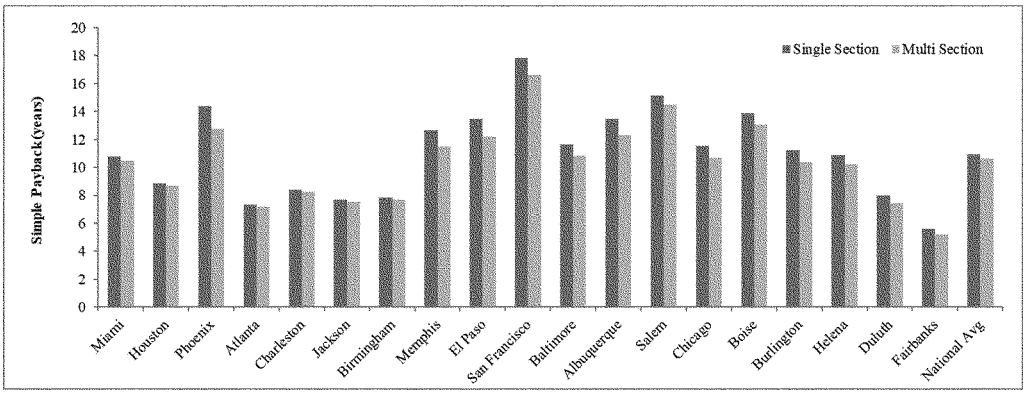


**Figure IV.9: Simple Payback Period Under the Untiered Standards**

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*B. Manufacturer Impacts*

DOE performed a manufacturer impact analysis (''MIA'') to estimate the potential financial impact of energy conservation standards on manufacturers of manufactured homes. The MIA relied on the Government Regulatory Impact Model (''GRIM''), an industry cash-flow model used to estimate changes in industry value as a result of energy conservation standards. The key GRIM inputs are: Industry financial metrics, manufacturer production cost estimates, shipments forecasts, conversion costs, and manufacturer markups. The primary output of the GRIM is industry net present value (''INPV''), which is the sum of industry annual cash flows over the analysis period (2021–2052), discounted using the industry average discount rate. The GRIM has a slightly different analysis period than the NIA and LCC since it accounts for the conversion period, the time between the announcement of the standard and the compliance date of the standard, because manufacturers may need to make upfront investments to bring their manufactured homes into compliance ahead of the standard going into effect. The GRIM estimates the impacts of more-stringent energy conservation standards on a given industry by comparing changes in INPV between the no-standards case and the standards cases. The GRIM estimates a range of possible impacts under different manufacturer markup scenarios to capture the uncertainty relating to manufacturer pricing strategy following new standards. Additional detail on the GRIM can be found in chapter 12 of the SNOPR TSD.

1. Conversion Costs

DOE analyzed the upfront investments manufacturers would need to make to bring their products into compliance with the proposed energy conservation standards. These upfront investments include product conversion costs and capital conversion costs. Product conversion costs are one-time expenses in research, development, engineering time, and other costs necessary to make product designs comply with energy conservation standards. Capital conversion costs are one-time investments in property, plant, and equipment to adapt or change existing production lines to fabricate and assemble new product designs that comply with the energy conservation standards.

DOE received comments regarding the conversion costs used for the cost-benefit analysis. MHARR commented that the June 2016 NOPR cost-benefit analysis failed to include costs for testing, certification, inspections, and other compliance related activities, including new testing that is not currently included in the HUD Code. It stated that there are enforcement costs as well as ongoing regulatory compliance costs. MHARR expressed concern that these costs were not included in calculating the manufacturer impact as well as incremental cost increases since compliance costs will inevitably be passed onto the consumer (MHARR, No. 154 at p. 27; MHARR, No. 143 at p. 4). MHCC also commented that the cost analysis does not include compliance costs and stated that the enforcement of the proposed rule significantly affects the costs, planning, and implementation (MHCC, No. 162 at p. 2).

As stated in the November 2016 test procedure NOPR, for the *R*-value of insulation, *U*-factor and SHGC of fenestration, and mechanical ventilation fan efficacy, DOE anticipates that MH manufacturers will not incur testing costs because they would be able to use values currently provided by component manufacturers as part of the component specification sheets. 81 FR 78733, 78742. As discussed in section II.B.3, DOE is not proposing any testing, compliance or enforcement provisions at this time. Therefore, DOE has not included any potential associated costs of testing, compliance or enforcement in this SNOPR.

RECA, Next Step Network, and Modular Lifestyles commented that many manufacturers produce higher efficiency homes that already meet the proposed standards, and thus the impacts for those manufacturers will be significantly reduced. (RECA, No. 188 at p. 2; Next Step, No. 174 at p. 1; Modular Lifestyles, No. 141 at p. 2).

DOE recognizes that some manufacturers already produce higher efficiency homes that meet the proposed standard level. DOE received data on the number of ENERGY STAR manufactured homes but lacked information on the number of manufactured homes that already meet or exceed the standard levels proposed in this SNOPR. Therefore, DOE conservatively assumed that all shipments are minimally compliant with the current HUD level and all models for which standards would be applicable would need design updates as a result of this proposed rule for the purposes of the MIA analysis. This prevents underestimation of negative impacts on manufacturers. As such, DOE's conversion costs are the same for the tiered and untiered proposals, as DOE models the maximum potential conversion costs.

In contrast, the NIA assumes conservatively that all ENERGY STAR manufactured homes would not provide additional national benefits as a result of this proposed rule, if made final. More information about the shipments analysis used for the NIA can be found in section IV.C.1.a of this document.

DOE estimated conversion costs to be $52,000 per manufacturer. This figure included approximately $49,000 per manufacturer for product conversion

costs, and approximately $3,000 per manufacturer for capital conversion costs for investments in equipment. The difference in product conversion costs from the June 2016 NOPR to the SNOPR are due to increased wage rates for mechanical engineers and taking into account fully burdened wages. DOE based its product conversion costs on the engineering time required to update model plans. DOE calculates industry conversion costs to be approximately $1.8 million. Those costs consist of $0.1 million in capital conversion costs and $1.7 million in product conversion costs.

DOE requests comment on the inputs to the conversion cost estimates.

2. Manufacturer Production Costs and Markups

DOE analyzed the effect the proposed standards would have on manufacturer production costs. DOE derived these costs from purchase price information and the markup factor, which is the product of the manufacturer markup, the retail markup, and sales tax. DOE used census data to obtain HUD minimum purchase price data by state for single-section and multi-section manufactured homes in 2019.[54] DOE used a shipment-weighted average to convert the average purchase price by state to an average purchase price for each of 19 representative cities.

DOE added incremental purchase prices to the HUD minimum purchase prices to calculate the purchase price for manufactured homes built in compliance with the proposed standard levels. The incremental purchase prices were negotiated during MH working group meetings and discussed further in section IV.A.1.g.

To calculate MPCs from purchase prices for homes at the baseline level and at the proposed standard levels, DOE divided the purchase prices by the markup factor. The markup factor is the product of the manufacturer markup, retail markup and the sales tax factor. In the June 2016 NOPR, DOE used public sources, including company SEC 10–K filings [55] and corporate annual reports, to estimate a manufacturer markup of 1.25. DOE used legislative analysis,[56] research reports from the Encyclopedia of Business,[57] and Highbeam Business [58] to estimate a retail markup of 1.30, and a sales tax of 1.03. This resulted in a combined cost markup factor of 1.67.

MHCC recommended that an industry projected cost markup factor of 2.30 be used, as opposed to the factor of 1.67 used by DOE in the June 2016 NOPR analysis (MHCC, No. 162 at p. 2). MHI expressed concern that the DOE markup factor of 1.67 is too low. It stated that HUD typically uses a markup factor of 2.30 and MHI's own study found a cost markup factor of 2.23. By using a lower markup factor, it expressed concern that DOE may be underestimating the impact of price increases passed onto the consumer (MHI, No. 182 at p. 5).

DOE investigated the research quoted by MHI and MHCC regarding the markup factor and found a supporting paper developed by Pacific Northwest National Laboratory (''PNNL'') on behalf of National Fire Protection Association, MHCC, and HUD that referenced their methodology for the distribution chain markups. The research paper indicates that DOE's estimated retail markup in the June 2016 NOPR of 1.30 is representative of the MH industry, whereas DOE's estimated manufacturer markup of 1.25 is too low.[59] Based on the comments received and the PNNL research, DOE increased the manufacturer markup from 1.25 to 1.72 in this SNOPR. Applying a manufacturer markup of 1.72, a retail markup of 1.30, and a sales tax factor of 1.03 results in a markup factor of 2.30, which is in-line with stakeholder comments.

COBA commented that the retail markup varies greatly depending on the nature of the distribution process. Independent MH retailers, who sell on a deal-by-deal and commission-only basis, will seek to maximize profitability. COBA said Land-Lease-Lifestyle Communities (LLL) Community operators will minimize the retail markup for HUD Code homes to get homeowners or site lessees to sign a rental agreement (COBA, No. 158 at p. 5). COBA stated that this change in the manufactured home distribution system leads to several different scenarios for markup. (COBA, Public Meeting Transcript, No. 148 at p. 124). DOE acknowledges that retail markups can vary based on the distribution channel. However, based on public information and comments received from interested parties, a retail markup of 1.30 is the industry average.

COBA also commented on the topic of sales tax assumptions used in DOE's MIA. COBA stated that sales tax is a state matter that varies depending on whether a manufactured home is new or used (COBA, No. 158 at p. 5). DOE agrees that sales taxes vary by state. To account for variations in sales taxes, DOE took the shipment-weighted average sales tax by state to estimate a national average sales tax of three percent. The MH working group reviewed the sales tax assumptions used in the DOE's analysis during the negotiated consensus process. The MH working group agreed to a national average sales tax of three percent for the purposes of DOE's analyses. This is consistent across the June 2016 NOPR and the SNOPR analyses. Additional information can be found in section 8.2.6 of the SNOPR TSD.

3. Manufacturer Markup Scenarios

DOE modeled two standard case manufacturer markup scenarios that reflect changes in the manufacturer's ability to pass on their upfront investments and increases in production costs to the consumer. The manufacturer markup scenarios represent the uncertainty regarding prices and profitability for manufactured home manufacturers following the implementation of the rule. DOE modeled a high and a low scenario for manufacturers' ability to pass on their increased costs to the consumer: (1) A preservation of gross margin percentage markup scenario; and (2) a preservation of operating profit markup scenario. These scenarios lead to different manufacturer markup values that result in varying revenue and cash flow impacts to the manufacturer when applied to the inputted manufacturer production costs.

Under the preservation of gross margin scenario, manufacturers maintain their current average markup of 1.72 even as production costs increase. Manufacturers are able to maintain the same amount of profit as a percentage of revenues, suggesting that they are able to recover conversion costs and pass the costs of compliance to their consumers. DOE considers this scenario the upper bound to industry profitability.

In the preservation of per-unit operating profit scenario, manufacturer markups are set so that the per-unit operating profit in the standards case equals the per-unit operating profit in the no-standards case one year after the compliance date of the new energy conservation standard. Under this scenario, as the costs of production increase under a standards case, manufacturers are required to reduce their markups. The implicit assumption behind this markup scenario is that the

[54] *https://www2.census.gov/programs-surveys/mhs/tables/2017/stavg17.xls.*

[55] U.S. Securities and Exchange Commission. Annual 10–K Reports. Various Years. *http://sec.gov.*

[56] Cook. State Board of Equalization, Staff Legislation Bill Analysis, Assembly Bill 1474 (2009).

[57] SIC 6515 Operators of Residential Mobile Home Site. Encyclopedia of Business.

[58] Highbeam Business. Operators of Residential Mobile Homes Sites.

[59] *http://aceee.org/files/proceedings/2004/data/papers/SS04_Panel1_Paper05.pdf.*

industry can only maintain its existing per-unit operating profit in absolute dollars after compliance with the new standard is required. Therefore, the operating margin is reduced between the no-standards case and standards case. Under this scenario, manufacturers are not able to recover the conversion period investments made to comply with the standard. This manufacturer markup scenario represents a lower bound to industry profitability under a new energy conservation standard.

4. Cash-Flow and INPV Results

DOE calculated an industry average discount rate of 9.2 percent based on SEC filings for public manufacturers of manufactured homes. The INPV is the sum of the discounted cash flows over the analysis period, which begins in 2021 and ends in 2052, using the industry average discount rate. DOE compares the INPV of the no-standards case to that of the standard level. The difference between INPV in the no-standards case and INPV in the standards case is an estimate of the economic impacts on the industry.

TABLE IV.18—INPV RESULTS: PRESERVATION OF GROSS MARGIN PERCENTAGE SCENARIO *

| | Tiered proposal | | Untiered proposal | |
|---|---|---|---|---|
| | Single-section | Multi-section | Single-section | Multi-section |
| No-standards case INPV (billion 2020$) | 4.87 | 11.36 | 4.87 | 11.36 |
| Standards Case INPV (billion 2020$) | 4.98 | 11.58 | 5.02 | 11.61 |
| Change in INPV (billion 2020$) | 0.10 | 0.22 | 0.15 | 0.25 |
| Change in INPV (%) | 2.1 | 1.9 | 3.0 | 2.2 |
| Total Conversion Costs (billion 2020$) | 0.0005 | .0012 | 0.0005 | .0012 |

* Values in parentheses are negative values.

TABLE IV.19—INPV RESULTS: PRESERVATION OF OPERATING PROFIT MARKUP SCENARIO *

| | Tiered proposal | | Untiered proposal | |
|---|---|---|---|---|
| | Single-section | Multi-section | Single-section | Multi-section |
| No-standards case INPV (billion 2020$) | 4.87 | 11.36 | 4.87 | 11.36 |
| Standards Case INP (billion 2020$) | 4.80 | 11.16 | 4.74 | 11.15 |
| Change in INPV (billion 2020$) | (0.07) | (0.20) | (0.13) | (0.21) |
| Change in INPV (%) | (1.5) | (1.8) | (2.7) | (1.8) |
| Total Conversion Costs (billion 2020$) | 0.0005 | 0.0012 | 0.0005 | .0012 |

* Values in parentheses are negative values.

For single-section units, the no-standards case INPV is $4.87 billion. The tiered proposal standard level could result in a change of industry value ranging from −1.5 percent to 2.1 percent, or a change of −$0.07 billion to $0.10 billion, for single-section units. For multi-section units, the no-standards case INPV is $11.36 billion. The tiered proposal standard level could result in a change of industry value ranging from −1.8 percent to 1.9 percent, or a change of −$0.20 billion to $0.22 billion. For the entire industry, the no-standards case INPV is $16.23 billion. The tiered proposal standard level could result in a change in INPV of −1.7 percent to 2.0 percent, or a change of −$0.28 billion to $0.32 billion. Industry conversion costs total $0.0018 billion.

For single-section units, the no-standards case INPV is $4.87 billion. The untiered proposal's standard level could result in a change of industry value ranging from −2.7 percent to 3.0 percent, or a change of −$0.13 billion to $0.15 billion for single-section units. For multi-section units, the no-standards case INPV is $11.36 billion. The untiered proposal's standard level could result in a change of industry value ranging from −1.8 percent to 2.2 percent, or a change of −$0.21 billion to $0.25 billion. For the entire industry, the no-standards case INPV is $16.23 billion. The untiered proposal's standard level could result in a change in INPV of −2.1 percent to 2.4 percent, or a change of −$0.34 billion to $0.39 billion. Industry conversion costs total $0.0018 billion.

5. Impact of Any Lessening of Competition

DOE also received comments regarding competition within the manufactured housing industry. GWU stated that DOE should pay particular attention to the prospective effects of the proposed rule on competition within the MH market. It commented that it was unable to find any analyses by the DOJ on market competition regarding the rule (GWU, No. 175 at p. 11). MHARR also asserted that the June 2016 NOPR would have anti-competitive effects and result in highly negative impacts on the industry's small manufacturers. MHARR stated that the June 2016 NOPR would lead to further consolidation in the industry. (MHARR, No. 154 at p. 33, 34)

The authority for the rule proposed in this document is section 413 of EISA (42 U.S.C. 17071), which is a separate authority from that governing appliance standards, *i.e.,* EPCA, as amended (42 U.S.C. 6291−6317). Section 413 of EISA does not require consultation with the DOJ regarding potential anticompetitive effects of the rule, as would be required for an appliance standard rulemaking. As such, DOE did not consult with the DOJ regarding potential anticompetitive impacts of this proposed rule.

DOE considered the impacts of this rulemaking on small manufacturers. In response to concerns related to potential adverse impacts on price-sensitive, low-income purchasers of manufactured homes, DOE is proposing updated standard levels that are different from the June 2016 NOPR levels, upon which MHARR's comment are based. In the updated proposed standards, described in detail in section III.A.2, DOE structured the tiered standard to address affordability concerns for low-income home buyers and for the small manufacturers that serve that segment of the market. Furthermore, DOE conducted additional analysis, found in section V.B.4, to understand the magnitude of upfront cost impacts of

small manufacturers. DOE expects conversion costs to be less than 0.1 percent of average small manufacturer annual revenue. DOE finds this level of investment unlikely to be the driver of industry consolidation or to affect market concentration.

*C. Nationwide Impacts*

The national impact analysis (NIA) assesses the national energy savings (NES) and the national net present value (NPV) from a national perspective of total consumer costs and savings that would be expected to result from new or amended standards. ''Consumer'' in this context refers to consumers of the product being regulated. DOE calculates the NES and NPV based on projections of annual product shipments, along with the annual energy consumption and total incremental cost data from the LCC analyses.

In the June 2016 NOPR, DOE's NIA projected a net benefit to the nation as a whole as a result of the proposed rule in terms of NES and the NPV of total consumer costs and savings that would be expected as a result of the proposed rule in comparison with the minimum requirements of the HUD Code. DOE calculated the NES and NPV based on annual energy consumption and total construction and lifecycle cost data from the LCC analysis (developed during the MH working group negotiation process), and shipment projections. DOE projected the energy savings, operating cost savings, equipment costs, and NPV of consumer benefits sold in a 30-year period from 2017 through 2046. The analysis also accounted for costs and savings for a manufactured home lifetime of 30 years.

In addition, for the June 2016 NOPR, DOE developed a shipments model to forecast the shipments of manufactured homes during the analysis period. DOE first gathered historical shipments spanning 1990–2013 from a report developed and written by the Institute for Building Technology and Safety and published by the Manufactured Housing Institute.[60] Then, using the growth rate (1.8 percent) in new residential housing starts from the *AEO 2015,* DOE projected the number of manufactured housing shipments from 2014 through 2046 in the no-standards case (no new standards adopted by DOE). For the standards case shipments, DOE used this same growth rate estimate (1.8 percent), but also applied an estimate for price elasticity of demand. Price elasticity of demand (price elasticity) is an economic concept that describes the change of the quantity demanded in response to a change in price. DOE used the price elasticity value of −0.48 (a 10-percent price increase would translate to a 4.8-percent reduction in manufactured home shipments) based on a study published in the Journal of Housing Economics by Marshall and Marsh for estimating standards case shipments.[61]

DOE conducted sensitivity analyses in order to account for the ranges of estimates available for shipment assumptions. The analysis focused on changes to two parameters: The shipment growth rate and the price elasticity of demand. In the first sensitivity analysis, the shipment growth rate was changed to 6.5 percent instead of 1.8 percent based on the trend in actual manufactured home shipments from 2011 to 2014. This growth rate applies to both the no-standards case and standards case shipments. In a second sensitivity analysis, DOE considered a standards case shipment scenario in which the price elasticity is −2.4 (instead of −0.48). This would project a 2.4 percent reduction in shipments based on the projected cost increases in the June 2016 NOPR. DOE based this sensitivity case on previous HUD estimates of −2.4 price elasticity based on a 1992 paper written by Carol Meeks.[11] This would translate to a 12 percent reduction in shipments based on a 5 percent increase in price.

DOE received a number of comments regarding several aspects of the nationwide impacts described in the June 2016 NOPR. The following sections provide a discussion of each of the submitted comments as well as updates to the NIA conducted for this SNOPR.

1. Discussion of Comments and Analysis Updates

a. Shipments Analysis

DOE received numerous comments on the June 2016 NOPR regarding the methodology and assumptions used in the shipments analysis. In the June 2016 NOPR, for the no-standards case shipments, DOE assumed that all current manufactured home shipments reported by MHI are for manufactured homes that are minimally compliant with the HUD Code. NEEA commented that 54 percent of the manufactured homes built in the Pacific Northwest are built to the EPA's ENERGY STAR program specifications (NEEA, No. 190 at p. 4).

Because ENERGY STAR-certified manufactured homes are more efficient than minimally HUD Code-compliant homes, DOE agrees that ENERGY STAR homes should not be accounted for in the no-standard shipments and national impact analyses, so as to avoid overestimating energy savings and NPV benefits to the consumer. In this SNOPR, DOE's NIA analysis is based on the assumption that ENERGY STAR-certified manufactured homes would not provide additional national benefits as a result of this proposed rule, if made final.[62] As a result, the national savings in the SNOPR only accrue to projected no-standards case shipments that are not ENERGY STAR-certified. Further details on this shipment update is discussed in chapter 10 of the SNOPR TSD.

DOE also received comments regarding the volume of manufactured housing shipments in the future. NEEA commented that the manufactured housing market has risen in recent years and it predicts the volume of homes built will be 20–40 percent higher than estimates used in DOE's NOPR analysis. (NEEA, No. 190 at p. 4) Southern Company commented that it believes that the shipment analysis should include a ''spike'' or large increase in shipments in the 2030s to serve as replacements for homes built in the late 1990s and early 2000s, during which time a similar large spike in shipments was observed. (Southern Company, Public Meeting Transcript, No. 148 at p. 104)

DOE acknowledges that there are a variety of factors that could affect future manufactured home shipments. For the June 2016 NOPR, DOE determined the shipment growth rate from the *AEO 2015* projections of new housing starts. The *AEO* projections, focused on U.S. energy markets, are based on results from NEMS, which enables EIA to make projections under internally consistent sets of assumptions. Since the June 2016 NOPR, DOE reviewed the new *AEO 2020* projections, and determined an updated housing start growth rate of 0.3 percent. DOE continues to use the housing start growth rate from *AEO 2020* in the absence of any growth rate information specific to manufactured housing. In addition, DOE has updated the shipment analysis to include the 2015–2019 shipment data provided through MHI, which was the latest data available at the time of the SNOPR analysis. Furthermore, DOE also

[60] See Manufactured Home Shipments by Product Mix (1990–2013), Manufactured Housing Institute (2014).

[61] See Marshall, M. I. & Marsh, T. L. Consumer and investment demand for manufactured housing units. *J. Hous. Econ.* 16, 59–71 (2007).

[62] ENERGY STAR version 2 requirements for manufactured homes can be found at: *https://www.energystar.gov/partner_resources/residential_new/homes_prog_reqs/national_page.*

performed a sensitivity analysis where the shipment growth rate was changed to 6.5 percent based on the trend in actual manufactured home shipments from 2011 to 2014. The results of this analysis are provided in section IV.C.2 of this document.

DOE also recognizes that manufactured homes that reach the end of their useful life may eventually need to be replaced, and DOE agrees with Southern Company that replacement of old manufactured homes does indeed occur in the market and can cause an upshift in shipments. However, the ownership period of a manufactured home may vary drastically between different consumers and different manufactured homes. Furthermore, there may be homeowners who do not purchase a second manufactured home. Therefore, DOE bases future shipments on historical trends and residential housing start growth rates rather than replacements.

Regarding the source of the manufactured housing shipment data, COBA commented that the Institute for Building Technology and Safety (''IBTS'') is the primary source for HUD Code housing data and suggested that DOE contact IBTS directly to guarantee the most accurate data. (COBA, No. 158 at p. 5) DOE determined shipments from the annual production and shipment data provided by MHI.[63] The data source for the shipments provided by MHI is IBTS. Since the June 2016 NOPR, DOE has updated the shipment analysis to include the 2015–2019 shipment data provided through MHI, which was the latest data available at the time of the SNOPR analysis.

DOE also received comments on the June 2016 NOPR regarding the changes currently taking place within the manufactured housing market. COBA commented that the overall distribution of manufactured homes has undergone a paradigm change, where roughly 500 portfolio operators of LLL Communities own the majority of new HUD Code homes. It said this change was not addressed by the MH working group and will greatly affect the cost of implementing the new DOE energy conservation standards. (COBA, No. 158 at p. 3) COBA commented that the sales of HUD Code homes through traditional distribution (via independent MH retailers and other manufacturers) have plummeted in the 21st century with loss of easy access to chattel capital. However, portfolio LLL Community operators have since realized that selling new homes on-site is the best method for success. COBA stated that in 2009, 25 percent of new HUD Code homes were shipped to LLL Communities; in 2015, it was closer to 40 percent, and is predicted to be 75 percent of new homes by 2020. (COBA, No. 158 at p. 7) COBA also stated that these newer large portfolios are very susceptible to price adjustments and are going to be hurt by the increase in price. (COBA, Public Meeting Transcript, No. 148 at p. 14, 27)

DOE appreciates the information regarding shipment distribution provided by COBA. However, DOE's LCC analysis focuses primarily on the effects of the rule on the individual consumers of manufactured homes. This proposed standard provides for a balanced approach regarding increased purchase price of the manufactured home in view of energy cost savings over time for a consumer. DOE's LCC analysis tentative results are provided in section IV.A.2. The LCC analysis applies to all consumers, regardless of whether they purchase the home from a commercial retailer or an onsite community operator.

In addition, DOE's shipment analysis studies the effect of the incremental price increases of the energy conservation standard on the total amount of manufacturer shipments in the United States and does not differentiate on who actually sells the home to consumers. The no-standards case shipments include shipments that are minimally compliant to the HUD Code. Furthermore, DOE's analysis for the standards-case shipments includes a price elasticity factor describing the change in future shipments in response to the energy conservation standards. Section IV.C.1.b provides more details regarding the price elasticity used in the analysis.

In this SNOPR, DOE also had to determine the percentage of the total shipments that would be applicable to each of the tiers analyzed based on HUD zone under the tiered proposal. Accordingly, DOE developed shipments for each of the tiers using the MHS 2019 PUF data discussed in III.A.2.[64] First, DOE estimated that manufactured homes in Census regions (the U.S. Census Bureau divides the country into four census regions) 1, 2 and 4 combined were representative of HUD zone 3 and manufactured homes in Census region 3 were representative of HUD zones 1 and 2. Second, DOE considered that a percentage of manufactured homes placed/sold would shift to less stringent standards, *i.e.,* a percentage of homes from Tier 2 would shift to Tier 1. The inclusion of this shift in the market is to more accurately estimate energy savings (and other downstream results) if the proposed tiered standard approach is finalized. For this analysis, DOE applied a ''substitution effect'' of 20 percent to homes within $1000 of the price threshold ($55,001–$56,000). For example, 20 percent of homes placed/sold in the $55,001–$56,000 range (as provided by the MHS 2019 PUF dataset) would move to Tier 1 and would be subject to less stringent thermal envelope standards. DOE chose a higher-end estimate of 20 percent based on reports that were reviewed for the energy conservation standards rulemaking for residential furnaces. 81 FR 65720, 65772. The reports reviewed included estimates for direct rebound effects of household heating as it relates to more efficient products used more intensively. While the concept of ''rebound effect'' for the residential furnaces rulemaking is different than the ''substitution effect'' that is being considered in this rulemaking, with the lack of any data specific to the rebound effect for manufactured homes, DOE determined that 20 percent is a reasonable proxy for the substitution effect analysis being performed in this SNOPR.

As a result, Table IV.23 provides the corresponding percentage of total manufactured homes placed/sold applicable to each tier based on HUD zone and size. These percentages were applied to the total shipments to determine the shipments for each tier. Further discussion on this analysis is provided in the Chapter 10 of the SNOPR TSD. Without the substitution effect applied, there would be more shipments in the Tier 2 standard for all climate zones, which would increase the national energy savings from the tiered standard.

[63] See Manufactured Home Shipments by Product Mix, Manufactured Housing Institute (2019).

[64] Manufactured Housing Survey, Public Use File (PUF) 2019. *https://www.census.gov/data/datasets/2019/econ/mhs/puf.html.*

TABLE IV.20—SHIPMENT BREAKDOWN BASED ON TIER AND PROPOSED CLIMATE ZONE

| | Climate zone 1 or 2 | | Climate zone 3 | |
|---|---|---|---|---|
| | SS (%) | MS (%) | SS (%) | MS (%) |
| Tier 1 Standard | 53.58 | 0 | 57.32 | 0 |
| Tier 2 Standard | 46.42 | 100.00 | 42.68 | 100.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 |

DOE requests comment on the shipment breakdown per tier and using a substitution effect of 20 percent on shipments to account for the shift in homes sold to the lower tiered standard. DOE requests comment on whether it should use a different substitution effect value for this analysis—and if so, why. (Please provide data in support of an alternative substitution effect value.)

b. Price Elasticity of Demand

Price elasticity of demand (price elasticity) is an economic concept that describes the change of the quantity demanded in response to a change in price. Price elasticity is typically represented as a ratio of the percentage change in quantity relative to a percentage change in price. It allows DOE to assess the extent to which consumers and retailers are unable or unwilling to purchase new homes as a result of the increased costs. In the June 2016 NOPR, DOE used a price elasticity value of −0.48 to estimate the effect of the proposed rule on manufactured home shipments. This value was sourced from a study by Marshall and Marsh.[65]

DOE received several comments on the June 2016 NOPR regarding the price elasticity that was used in the NOPR. MHARR stated that the −0.48 value was published in 2007 prior to the collapse of the housing market in 2008–2009. (MHARR, Public Meeting Transcript, No. 148 at p. 112) Southern Company and MHI expressed that the elasticity value of −0.48 seemed too low, particularly considering that a large part of the manufactured housing market is low-income households. Southern Company indicated that an elasticity value of –1 would be more intuitive. (Southern Company, Public Meeting Transcript, No. 148 at p. 110) MHI stated that HUD uses an elasticity value of −2.4 instead, which would yield a much greater decrease in production as a result of this standard. MHI indicated that both values are outdated, and that DOE may be underestimating the impact of the proposed rule. MHI suggested that DOE and HUD develop a new elasticity measure that is more up to date and accurately measures price sensitivity from manufacturers and retailers. (MHI, No. 182 at p. 5) MHCC also stated that the June 2016 NOPR analysis underestimates the reduction in production levels due to the proposed rule by using −0.48, which they deemed too low. (MHCC, No. 162 at p. 2)

DOE reviewed the Meeks study cited by HUD, as well as various others, and concluded that the Marshall and Marsh elasticity value of −0.48 was the most reliable figure. The Meeks study was published in 1993 and is based on manufactured housing shipments as a proxy for consumer demand.[66] The data from the study ranges from 1961 to 1989 and found an overall price elasticity of −2.4. The Meeks study used a one-stage regression model, similar to a study by Gates in 1984 which found elasticities from −3.0 to −2.5.[67] A study in 1994 by Kavanaugh re-evaluated the methods behind the Gates study, using a two-stage regression instead of one stage. Using shipment data from 1972 to 1989, the Kavanaugh study reported a price elasticity estimate of −0.7.[68]

Marshall and Marsh used the number of new manufactured homes placed for residential use as a proxy for consumer demand and also separated short-term consumer behavior from long-term influences. As part of their paper, Marshall and Marsh reviewed all the aforementioned studies (including Meeks', Gates', and Kavanaugh's studies) to determine the inputs into their model. They used national level data from similar sources to the Meeks, Gates, and Kavanaugh studies for their consumer demand model. Marshall and Marsh estimated the price elasticity of demand for manufactured homes at −0.48 using a two-stage regression model and concluded that consumers in general are not so price sensitive and are likely willing to accept incremental higher prices for improvements in cost efficiency. For the NIA, DOE determined the Marshall and Marsh study is still the most recent estimate of consumer demand based on price changes for manufactured housing and maintains the proposed usage of the −0.48 elasticity value. In recognition of the range of estimates in the housing literature, DOE also retained −2.4 as a sensitivity analysis. As discussed previously, DOE is proposing Tier 1 of the tiered standard to address concerns about affordability for low-income consumers. DOE estimates that based on a price elasticity of −0.48, the SNOPR would result in a loss in demand and availability of about 53,329 homes (single section and multi-section combined) for the tiered standard. Out of the 53,329 homes in the tiered standard, the majority of the reduction is in Tier 2 (93 percent) vs. Tier 1 (7 percent). Within Tier 1, DOE estimates a 0.52 percent reduction (essentially no reduction) in availability due to Tier 1 standards for low income purchasers. As a sensitivity, DOE also considered a price elasticity of demand of −2.4 instead of −0.48. Further discussion on this sensitivity is provided in Section 10.4 of Chapter 10 of the TSD. Table IV.1 provides a summary of the change in shipments from baseline for the tiered standards for a price elasticity of −0.48 and −2.4 to reflect the people who do not buy a manufactured home under the standards case because they are price-sensitive.

c. Net Present Value

DOE received a comment concerning the discount rates used to calculate the NPV. GWU commented that it has concerns regarding the 3-percent and 7-percent discount rate used by DOE in the annualized benefits and costs calculation in the June 2016 NOPR. GWU stated that DOE's 3-percent and 7-percent discount rates were too low and that a more realistic discount rate, such as chattel loan rates, would reflect a much lower benefit to consumers. (GWU, No. 175 at p. 5)

[65] See Marshall, M.I. & Marsh, T.L. Consumer and investment demand for manufactured housing units. *J. Hous. Econ.* 16, 59–71 (2007).

[66] See Meeks, C., 1992, Price Elasticity of Demand for Manufactured Homes: 1961–1989.

[67] See Gates, H., 1984. Price Elasticity of Demand for Manufactured Homes. Manufactured Housing Institute.

[68] See Kavanaugh, DC, Anderson, D.M., Marsh, T.L., Lee, A.D., Onisko, S., 1994. Key Elements Affecting Manufactured Home Household Investments in Energy-Efficiency: An Empirical Analysis.

DOE generally uses real discount rates of 3 percent and 7 percent to discount future costs and savings to present values.[69] The 3- and 7-percent discount rates are based on Circular A–4 issued by the Office of Management and Budget (OMB) as guidance on the development of regulatory analysis as required by Executive Order (E.O.) 12866.[70] The 7-percent rate is the established estimate of the average rate of return, before tax, to private capital in the U.S. economy. The 3-percent rate is called the ''social rate of time preference,'' which is the rate at which society discounts future consumption flows to their present value.[71] These real discount rates are used to calculate annualized benefits and costs in DOE rulemakings in order to perform cross-industry comparisons in a standardized manner. In the SNOPR, DOE maintains discount rates of 3 percent and 7 percent for the NPV and the annualized benefits and costs. Additionally, as discussed in section IV.A.1.c, DOE uses a discount rate based on the chattel loan interest rate in the LCC analysis.

d. Other Comments

DOE also received another comment that was not specific to any of the previous topics regarding nationwide impacts. NPGA commented that it appreciated DOE's use of full-fuel cycle analysis. It also supported the estimated reduction of pollutants and greenhouse gases for both site and upstream emissions. (NPGA, No. 171 at p.1) DOE appreciates NPGA's comment, and continues to use the full-fuel cycle analysis in this SNOPR.

2. Results

This section provides the tentative results for the projected nationwide impact analyses, including the NES and NPV. In this SNOPR, DOE updated the energy efficiency measures analyzed as described in section III.E.2.b. DOE also updated all inputs to the NES and NPV based on the updated *AEO 2020.* This includes updates to the housing starts growth rate, inflation rates, energy prices, energy prices growth rates, and full-fuel cycle energy factors. In addition, DOE also updated the shipment analysis to include the 2015–2019 MHI shipments and exclude any ENERGY STAR shipments to avoid overestimating energy savings. Furthermore, for the tiered proposal, DOE had to determine shipments per tier, as described in section IV.C.1.a, by implementing a substitution effect of shifting Tier 2 shipments to Tier 1 for the tiered proposal. Lastly, the analyses include updates to the average price of a manufactured home, and fuel type distributions. Further details on the updated inputs are discussed in chapters 8, 10, and 11 of the SNOPR TSD.

DOE notes that the NES does not account for the energy savings for the people who do not buy a manufactured home under the standards case because they are price-sensitive. As such, NES only accounts for savings for those that are able to purchase a manufactured home. The NES is calculated based on the same number of homes purchased under both the standards and no standards case such that there are no energy savings attributed to less homes purchased.

Table IV. reflects the NES results over a 30-year analysis period under the SNOPR on a primary energy savings basis. Primary energy savings apply a factor to account for losses associated with generation, transmission, and distribution of electricity. Primary energy savings differ among the different climate zones because of differing energy conservation requirements in each climate zone and different shipment projections in each climate zone.

TABLE IV.20—CUMULATIVE NATIONAL ENERGY SAVINGS OF MANUFACTURED HOMES PURCHASED 2023–2052 WITH A 30-YEAR LIFETIME

| | Tiered standards | | Untiered standard | |
|---|---|---|---|---|
| | Single-section (quads) | Multi-section (quads) | Single-section (quads) | Multi-section (quads) |
| Climate Zone 1 | 0.213 | 0.591 | 0.303 | 0.591 |
| Climate Zone 2 | 0.164 | 0.467 | 0.243 | 0.467 |
| Climate Zone 3 | 0.300 | 0.463 | 0.376 | 0.463 |
| Total | 0.677 | 1.521 | 0.921 | 1.521 |

Table IV.21 illustrates the cumulative NES over the 30-year analysis period for the tiered proposals on an FFC energy savings basis. FFC energy savings apply a factor to account for losses associated with generation, transmission, and distribution of electricity, and the energy consumed in extracting, processing, and transporting or distributing primary fuels. NES values differ among the different climate zones because of differing energy efficiency requirements in each climate zone and different shipment projections in each climate zone.

TABLE IV.21—CUMULATIVE NATIONAL ENERGY SAVINGS, INCLUDING FULL-FUEL-CYCLE OF MANUFACTURED HOMES PURCHASED 2023–2052 WITH A 30-YEAR LIFETIME

| | Tiered standards | | Untiered standard | |
|---|---|---|---|---|
| | Single-section (quads) | Multi-section (quads) | Single-section (quads) | Multi-section (quads) |
| Climate Zone 1 | 0.222 | 0.616 | 0.316 | 0.616 |
| Climate Zone 2 | 0.172 | 0.491 | 0.254 | 0.491 |
| Climate Zone 3 | 0.324 | 0.499 | 0.405 | 0.499 |

[69] DOE relies on a range of discount rates in monetizing emission reductions as discussed in section IV.D.2 of this document.

[70] *https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A4/a-4.pdf.*

[71] Office of Management and Budget, Circular A–4, September 2003.

TABLE IV.21—CUMULATIVE NATIONAL ENERGY SAVINGS, INCLUDING FULL-FUEL-CYCLE OF MANUFACTURED HOMES PURCHASED 2023–2052 WITH A 30-YEAR LIFETIME—Continued

| | Tiered standards | | Untiered standard | |
|---|---|---|---|---|
| | Single-section (quads) | Multi-section (quads) | Single-section (quads) | Multi-section (quads) |
| Total | 0.718 | 1.606 | 0.976 | 1.606 |

Without the substitution effect applied, the total cumulative FFC energy savings for the tiered standards would increase by 0.2 percent.

Table IV.22 and Table IV.23 illustrate the NPV of consumer benefits over the 30-year analysis period under the tiered proposals for a discount rate of 7 percent and 3 percent, respectively. The NPV of manufactured homeowner benefits differ among the different climate zones because there are different upfront costs and operating cost savings associated with each climate zone and different shipment projections in each climate zone. For the primary tiered proposal, all climate zones have a positive NPV for both discount rates under this SNOPR.

TABLE IV.22—NET PRESENT VALUE OF MANUFACTURED HOMES PURCHASED 2023–2052 WITH A 30-YEAR LIFETIME AT A 7% DISCOUNT RATE

| | Tiered standards | | Untiered standard | |
|---|---|---|---|---|
| | Single-section (billion 2020$) | Multi-section (billion 2020$) | Single-section (billion 2020$) | Multi-section (billion 2020$) |
| Climate Zone 1 | $0.22 | $0.47 | $0.24 | $0.46 |
| Climate Zone 2 | 0.08 | 0.08 | 0.00 | 0.06 |
| Climate Zone 3 | 0.42 | 0.36 | 0.26 | 0.35 |
| Total | 0.72 | 0.90 | 0.49 | 0.87 |

TABLE IV.23—NET PRESENT VALUE OF MANUFACTURED HOMES PURCHASED 2023–2052 WITH A 30-YEAR LIFETIME AT A 3% DISCOUNT RATE

| | Tiered standards | | Untiered standard | |
|---|---|---|---|---|
| | Single-section (billion 2020$) | Multi-section (billion 2020$) | Single-section (billion 2020$) | Multi-section (billion 2020$) |
| Climate Zone 1 | $0.70 | $1.69 | $0.85 | $1.63 |
| Climate Zone 2 | 0.38 | 0.79 | 0.29 | 0.73 |
| Climate Zone 3 | 1.34 | 1.50 | 1.12 | 1.44 |
| Total | 2.42 | 3.98 | 2.26 | 3.80 |

Table IV.24 shows the tentative projected benefits and costs to the manufactured homeowner associated with the SNOPR, expressed in terms of annualized values.

TABLE IV.24—ANNUALIZED BENEFITS AND COSTS TO MANUFACTURED HOME HOMEOWNERS UNDER THE SNOPR

| | Discount rate (%) | Monetized (million 2020$/year) | | |
|---|---|---|---|---|
| | | Primary estimate ** | Low estimate ** | High estimate ** |
| **Tiered Standards** | | | | |
| Benefits * | | | | |
| Operating (Energy) Cost Savings | 7 | $509 | $471 | $554 |
| | 3 | 774 | 701 | 858 |
| Costs * | | | | |
| Incremental Purchase Price Increase | 7 | 359 | 352 | 385 |
| | 3 | 427 | 407 | 464 |
| Net Benefits/Costs * | | | | |
| | 7 | 150 | 119 | 169 |
| | 3 | 347 | 294 | 394 |

TABLE IV.24—ANNUALIZED BENEFITS AND COSTS TO MANUFACTURED HOME HOMEOWNERS UNDER THE SNOPR—Continued

| | Discount rate (%) | Monetized (million 2020$/year) | | |
|---|---|---|---|---|
| | | Primary estimate ** | Low estimate ** | High estimate ** |
| **Untiered Standard** | | | | |
| Benefits * | | | | |
| Operating (Energy) Cost Savings | 7 | 565 | 523 | 615 |
| | 3 | 859 | 778 | 951 |
| Costs * | | | | |
| Incremental Purchase Price Increase | 7 | 440 | 429 | 471 |
| | 3 | 530 | 503 | 576 |
| Net Benefits/Costs * | | | | |
| | 7 | 125 | 94 | 144 |
| | 3 | 329 | 275 | 375 |

* The benefits and costs are calculated for homes shipped in 2023–2052.
** The Primary, Low, and High Estimates utilize forecasts of energy prices from the *AEO 2020* Reference case, Low Economic Growth case, and High Economic Growth case, respectively.

DOE also estimated the deadweight loss associated with the proposed rule stemming from the reduced shipments in the standards case scenario. Deadweight loss is a cost to society as a whole generated by shifting the market away from the no-standards case equilibrium. If the supply curve is perfectly elastic, then the deadweight loss of an energy conservation standard is entirely borne by consumers and not producers. The deadweight loss is equivalent to one-half the incremental price multiplied by the reduction in total shipments, discounted over the 30-year analysis. If, however, the supply curve's slope near equilibrium is similar in magnitude to the demand curve, then the deadweight loss is equivalent to the incremental price multiplied by the reduction in total shipments, discounted over the 30-year analysis.

DOE does not have data on the supply curve elasticity, therefore DOE estimated the deadweight loss for the proposed standards using a price elasticity of −0.48.

DOE tentatively estimates that the discounted total deadweight loss for the standards based on Tier 1 range from $0.8 to $1.5 million (2020$, discounted at 3 percent) and $0.4 to $0.9 million (2020$, discounted at 7 percent). DOE tentatively estimates that the discounted total deadweight loss for the standards based on Tier 2 from $75.4 to $150.9 million (2020$, discounted at 3 percent) and $43.9 to $87.8 million (2020$, discounted at 7 percent). DOE tentatively estimates that the discounted total deadweight loss for the untiered standard range from $103.1 to $206.2 million (2020$, discounted at 3 percent) and $60 to $120 million (2020$, discounted at 7 percent).

DOE requests comment on the calculation of deadweight loss presented above and the extent to which there are market failures in the no-standards case.

DOE considered two sensitivity analyses relating to shipments. First, DOE considered a shipment scenario in which the growth rate is 6.5 percent (instead of 0.3 percent) based on the trend in actual manufactured home shipments from 2011 to 2014. This growth rate applies to both the no-standards case and standards case shipments. DOE's primary scenario is based on the residential housing start data from *AEO 2020*. The sensitivity analysis calculates the increase in NES and NPV associated with a much larger future market for manufactured homes. Table IV.25 summarizes the results of the sensitivity analysis. A detailed description of the sensitivity analysis is provided in appendix 11A of the SNOPR TSD.

TABLE IV.25—SHIPMENTS GROWTH RATE SENSITIVITY ANALYSIS NES AND NPV RESULTS

| | National energy savings (full fuel cycle quads) | Net present value 3% discount rate (billion 2020$) | Net present value 7% discount rate (billion 2020$) |
|---|---|---|---|
| **Tiered Standard** | | | |
| 0.3% Shipment Growth (primary scenario) | 2.32 | $6.40 | $1.62 |
| 6.5% Shipment Growth | 8.13 | 20.12 | 4.35 |
| **Untiered Standards** | | | |
| 0.3% Shipment Growth (primary scenario) | 2.58 | 6.07 | 1.36 |
| 6.5% Shipment Growth | 9.04 | 19.10 | 3.66 |

In a second sensitivity analysis, DOE considered a standards case shipment scenario in which the price elasticity is −2.4 (instead of −0.48). HUD has used an estimate of −2.4 in analyses of revisions to its regulations [72] promulgated at 24 CFR part 3282 based on a 1992 paper written by Carol Meeks.[73] DOE's primary scenario is based on a study published in 2007 in the *Journal of Housing Economics.* The sensitivity analysis calculates the decrease in NES and NPV associated with a larger decrease in shipments resulting from the more negative price elasticity value. See Table IV.26 for results of the sensitivity analysis. A detailed description of the sensitivity analysis is provided in appendix 11A of the SNOPR TSD.

TABLE IV.26—PRICE ELASTICITY OF DEMAND SENSITIVITY ANALYSIS NES AND NPV RESULTS

| | National energy savings (full-fuel cycle quads) | Net present value 3% discount rate (billion 2020$) | Net present value 7% discount rate (billion 2020$) |
|---|---|---|---|
| **Tiered Standards** | | | |
| −0.48 Price Elasticity (primary scenario) | 2.32 | $6.40 | $1.62 |
| −2.4 Price Elasticity | 2.12 | 5.90 | 1.51 |
| **Untiered Standard** | | | |
| −0.48 Price Elasticity (primary scenario) | 2.58 | 6.07 | 1.36 |
| −2.4 Price Elasticity | 2.31 | 5.46 | 1.23 |

*D. Nationwide Energy Savings and Emissions Benefits*

1. Emissions Analysis

DOE estimates environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases associated with electricity production. DOE bases these estimates on a 30-year analysis period of manufactured home shipments, accounting for a 30-year home lifetime. DOE's analysis estimates reductions in emissions of six pollutants associated with energy savings: Carbon dioxide ($CO_2$), mercury (Hg), nitric oxide and nitrogen dioxide ($NO_X$), sulfur dioxide ($SO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$). These reductions are referred to as ''site'' emissions reductions. Furthermore, DOE estimates reductions due to ''upstream'' activities in the fuel production chain. These upstream activities comprise extraction, processing, and transporting fuels to the site of combustion. Together, site emissions reductions and upstream emissions reductions account for the FFC.

As in the June 2016 NOPR, DOE estimated emissions reductions based on emission factors for each pollutant, which depend on the type of fuel associated with energy savings (electricity, natural gas, liquefied petroleum gas, fuel oil). The analysis of power sector emissions of $CO_2$, $NO_X$, $SO_2$, and Hg uses marginal emissions factors that were derived from data in AEO 2020.[74] Full details of this methodology are described in chapter 13 of the SNOPR TSD.

Because the onsite operation of manufactured homes may require combustion of fossil fuels and results in emissions of $CO_2$, $NO_X$, and $SO_2$ at the manufactured home sites where this combustion occurs, DOE also accounted for the reduction in these site emissions and the associated upstream emissions due to the standards. Site emissions of the above gases were estimated using emissions intensity factors from an EPA publication.[75] The emissions intensity factors are expressed in terms of physical units per MWh or MMBtu of site energy savings. Total emissions reductions are estimated using the energy savings calculated in the national impact analysis. As discussed previously in section IV.C.2, the energy savings calculated does not account for the energy savings for the people who do not buy a manufactured home under the standards case because they are price-sensitive, but only accounts for savings for those that are able to purchase a manufactured home. The energy savings is calculated based on the same number of homes purchased under both the standards and no standards case such that there are no energy savings attributed to less homes purchased. After calculating the total reduction of emissions, DOE estimated the monetized value associated with the reduction of these emissions, as discussed in section IV.D.2 of this document.

2. Monetizing Emissions Impacts

As part of the analysis of the impacts of this proposed rule, DOE considered the estimated monetary benefits from the reduced emissions of $CO_2$, $CH_4$, $N_2O$, $NO_X$ and $SO_2$ that are expected to result from the proposed energy standards. In order to make this calculation analogous to the calculation of the NPV of consumer benefit, DOE considered the reduced emissions expected to result over the lifetime of products shipped in the projection period for the standards. This section summarizes the basis for the values used for monetizing the emissions benefits in this SNOPR.

a. Monetization of Greenhouse Gas Emissions

DOE estimates the monetized benefits of the reductions in emissions of $CO_2$, $CH_4$, and $N_2O$ by using a measure of the social cost (''SC'') of each pollutant (*e.g.,* SC-$CO_2$). These estimates represent the monetary value of the net harm to society associated with a marginal increase in emissions of these pollutants in a given year, or the benefit of avoiding that increase. These estimates are intended to include (but are not limited to) climate-change-related changes in net agricultural productivity, human health, property damages from increased flood risk, disruption of energy systems, risk of conflict,

[72] For example, see *http://www.regulations.gov/#!documentDetail;D=HUD-2014-0033-0001.*

[73] Meeks, C., 1992, Price Elasticity of Demand for Manufactured Homes: 1961 to 1989.

[74] See Energy Information Administration, Annual Energy Outlook 2019 with Projections to 2050 (2019), available at *https://www.eia.gov/outlooks/aeo/pdf/AEO2019.pdf.*

[75] U.S. Environmental Protection Agency. External Combustion Sources. In *Compilation of Air Pollutant Emission Factors.* AP–42. Fifth Edition. Volume I: Stationary Point and Area Sources. Chapter 1. Available at *https://www.epa.gov/aiR-emissions-factors-and-quantification/ap-42-compilation-aiR-emissions-factors.*

environmental migration, and the value of ecosystem services.

DOE used the estimates for the social cost of greenhouse gases (''SC-GHG'') from the most recent update of the Interagency Working Group on Social Cost of Greenhouse Gases, United States Government (IWG) working group, from ''Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990.'' (February 2021 TSD). DOE has determined that the estimates from the February 2021 TSD, as described more below, are based upon sound analysis and provide well founded estimates for DOE's analysis of the impacts of the reductions of emissions anticipated from the proposed rule.

The SC-GHG estimates in the February 2021 TSD are interim values developed under Executive Order (E.O.) 13990 for use until an improved estimate of the impacts of climate change can be developed based on the best available science and economics. The SC-GHG estimates used in this analysis were developed over many years, using a transparent process, peer-reviewed methodologies, the best science available at the time of that process, and with input from the public. Specifically, an interagency working group (IWG) that included DOE, the EPA and other executive branch agencies and offices used three integrated assessment models (IAMs) to develop the SC-$CO_2$ estimates and recommended four global values for use in regulatory analyses. Those estimates were subject to public comment in the context of dozens of proposed rulemakings as well as in a dedicated public comment period in 2013.

The SC-$CO_2$ estimates were first released in February 2010 and updated in 2013 using new versions of each IAM. In 2015, as part of the response to public comments received to a 2013 solicitation for comments on the SC-$CO_2$ estimates, the IWG announced a National Academies of Sciences, Engineering, and Medicine review of the SC-$CO_2$ estimates to offer advice on how to approach future updates to ensure that the estimates continue to reflect the best available science and methodologies. In January 2017, the National Academies released their final report, Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide, and recommended specific criteria for future updates to the SC-$CO_2$ estimates, a modeling framework to satisfy the specified criteria, and both near-term updates and longer-term research needs pertaining to various components of the estimation process (National Academies 2017). On January 20, 2021, President Biden issued Executive Order 13990, which directed the IWG to ensure that the U.S. Government's (USG) estimates of the social cost of carbon and other greenhouse gases reflect the best available science and the recommendations of the National Academies (2017). The IWG was tasked with first reviewing the estimates currently used by the USG and publishing interim estimates within 30 days of E.O. 13990 that reflect the full impact of GHG emissions, including taking global damages into account, which resulted in the issuance of the February 2021 TSD. More information on the basis for the IWG's interim values may be found in the IWG's Technical Support Document.[76]

DOE's derivations of the SC-$CO_2$, SC-$N_2O$, and SC-$CH_4$ values used for this SNOPR are discussed in the following sections, and the results of DOE's analyses estimating the benefits of the reductions in emissions of these pollutants are presented in section IV.3.b of this document.

Social Cost of Carbon

The SC-$CO_2$ values used for this NOPR were generated using the values presented in the 2021 update from the IWG. Table IV.27 shows the updated sets of SC-$CO_2$ estimates from the latest interagency update in 5-year increments from 2020 to 2050. The full set of annual values used is presented in Appendix 14–A of the SNOPR TSD. For purposes of capturing the uncertainties involved in regulatory impact analysis, DOE has determined it is appropriate to include all four sets of SC-$CO_2$ values, as recommended by the IWG.[77] These SC-$CO_2$ estimates are the same as those used in the June 2016 NOPR except adjusted for inflation to 2020 dollars. The June 2016 NOPR provides further detail of DOE's SC-$CO_2$ analysis for the June 2016 NOPR. See 81 FR 39791.

TABLE IV.27—ANNUAL SC-$CO_2$ VALUES FROM 2021 INTERAGENCY UPDATE, 2020–2050

[2020$ per Metric Ton $CO_2$]

| Year | Discount rate | | | |
|---|---|---|---|---|
| | 5% (average) | 3% (average) | 2.5% (average) | 3% (95th percentile) |
| 2020 | 14 | 51 | 76 | 152 |
| 2025 | 17 | 56 | 83 | 169 |
| 2030 | 19 | 62 | 89 | 187 |
| 2035 | 22 | 67 | 96 | 206 |
| 2040 | 25 | 73 | 103 | 225 |
| 2045 | 28 | 79 | 110 | 242 |
| 2050 | 32 | 85 | 116 | 260 |

In calculating the potential global benefits resulting from reduced $CO_2$ emissions, DOE used the values from the 2021 interagency report, adjusted to 2020$ using the implicit price deflator for gross domestic product (GDP) from the Bureau of Economic Analysis. For each of the four sets of SC-$CO_2$ cases specified, the values for emissions in 2020 were $14, $51, $76, and $152 per metric ton avoided (values expressed in 2020$). DOE derived values after 2050 based on the trend in 2010–2050 in each of the four cases in the IWG update.

DOE multiplied the $CO_2$ emissions reduction estimated for each year by the SC-$CO_2$ value for that year in each of the four cases. To calculate a present value

[76] See Interagency Working Group on Social Cost of Greenhouse Gases, *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide. Interim Estimates Under Executive Order 13990,* Washington, DC, February 2021. (*https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf?source=email).*

[77] For example, the TSD discusses how the understanding of discounting approaches suggests that discount rates appropriate for intergenerational analysis in the context of climate change may be lower than 3 percent.

of the stream of monetary values, DOE discounted the values in each of the four cases using the specific discount rate that had been used to obtain the SC-$CO_2$ values in each case.

Social Cost of Methane and Nitrous Oxide

The SC-$CH_4$ and SC-$N_2O$ values used for this SNOPR were generated using the values presented in the 2021 update from the IWG.[78] Table IV.28 shows the updated sets of SC-$CH_4$ and SC-$N_2O$ estimates from the latest interagency update in 5-year increments from 2020 to 2050. The full set of annual values used is presented in Appendix 14–A of the SNOPR TSD. To capture the uncertainties involved in regulatory impact analysis, DOE has determined it is appropriate to include all four sets of SC-$CH_4$ and SC-$N_2O$ values, as recommended by the IWG.

TABLE IV.28—ANNUAL SC-$CH_4$ AND SC-$N_2O$ VALUES FROM 2021 INTERAGENCY UPDATE, 2020–2050

[2020$ per metric ton]

| Year | SC-$CH_4$ (discount rate and statistic) | | | | SC-$N_2O$ (discount rate and statistic) | | | |
|---|---|---|---|---|---|---|---|---|
| | 5% (Average) | 3% (Average) | 2.5% (Average) | 3% (95th percentile) | 5% (Average) | 3% (Average) | 2.5% (Average) | 3% (95th percentile) |
| 2020 | 670 | 1500 | 2000 | 3900 | 5800 | 18000 | 27000 | 48000 |
| 2025 | 800 | 1700 | 2200 | 4500 | 6800 | 21000 | 30000 | 54000 |
| 2030 | 940 | 2000 | 2500 | 5200 | 7800 | 23000 | 33000 | 60000 |
| 2035 | 1100 | 2200 | 2800 | 6000 | 9000 | 25000 | 36000 | 67000 |
| 2040 | 1300 | 2500 | 3100 | 6700 | 10000 | 28000 | 39000 | 74000 |
| 2045 | 1500 | 2800 | 3500 | 7500 | 12000 | 30000 | 42000 | 81000 |
| 2050 | 1700 | 3100 | 3800 | 8200 | 13000 | 33000 | 45000 | 88000 |

DOE multiplied the $CH_4$ and $N_2O$ emissions reduction estimated for each year by the SC-$CH_4$ and SC-$N_2O$ estimates for that year in each of the cases. To calculate a present value of the stream of monetary values, DOE discounted the values in each of the cases using the specific discount rate that had been used to obtain the SC-$CH_4$ and SC-$N_2O$ estimates in each case.

b. Monetization of Other Air Pollutants

For the SNOPR, DOE estimated the monetized value of $NO_X$ and $SO_2$ emissions reductions from electricity generation using benefit per ton estimates based on air quality modeling and concentration-response functions conducted for the Clean Power Plan final rule. EPA reported values for $NO_X$ (as $PM_{2.5}$) and $SO_2$ for 2020, 2025, and 2030 using discount rates of 3 percent and 7 percent. DOE developed values specific to the sector for manufactured housing using a method described in appendix 14B of the SNOPR TSD. For this analysis DOE used linear interpolation to define values for the years between 2020 and 2025 and between 2025 and 2030; for years beyond 2030 the value is held constant.

DOE estimated the monetized value of $NO_X$ and $SO_2$ emissions reductions from site use of gas in manufactured homes using benefit per ton estimates from the EPA's ''Technical Support Document Estimating the Benefit per Ton of Reducing $PM_{2.5}$ Precursors from 17 Sectors'' (''EPA TSD''). Although none of the sectors refers specifically to residential and commercial buildings, the sector called ''area sources'' would be a reasonable proxy for residential and commercial buildings. ''Area sources'' represents all emission sources for which states do not have exact (point) locations in their emissions inventories. Because exact locations would tend to be associated with larger sources, ''area sources'' would be fairly representative of small dispersed sources like homes and businesses. The EPA TSD provides high and low estimates for 2016, 2020, 2025, and 2030 at 3- and 7-percent discount rates. DOE primarily relied on the low estimates to be conservative.

DOE multiplied the emissions reduction (in tons) in each year by the associated $/ton values, and then discounted each series using discount rates of 3 percent and 7 percent as appropriate.

3. Discussion of Comments

DOE received a number of comments regarding several aspects of the nationwide environmental benefits described in the June 2016 NOPR. The following sections provide a discussion of each of the submitted comments, including the changes that DOE has made in the methodology and assumptions.

a. Social Cost of Carbon

DOE received several comments on the development of, and the use of the SC-$CO_2$ values in DOE's analysis in the June 2016 NOPR. A group of trade associations led by the U.S. Chamber of Commerce objected to DOE's continued use of the SC-$CO_2$ in the cost-benefit analysis and stated that the SC-$CO_2$ calculation should not be used in any rulemaking until it undergoes a more rigorous notice, review, and comment process. (U.S. Chamber of Commerce., No. 181 at p. 4) The Cato Institute also criticized DOE's use of SC-$CO_2$ estimates on the basis that they are subject to considerable uncertainty. The Cato Institute criticized several aspects of the determination of the SC-$CO_2$ values by the IWG as being discordant with the best climate science, highly sensitive to input parameters and scope of the models, and not reflective of climate change impacts. The Cato Institute stated that until integrated assessment models (IAMs) are made consistent with what it stated is mainstream climate science, the SC-$CO_2$ should be barred from use in this and all other Federal rulemakings. (Cato Institute, No. 180 at pp. 1–4, 15–16). MHARR stated that the global benefits calculated via the SC-$CO_2$ in the analysis are not only unreliable and arbitrary, but also compare the monetary benefits to the world to a rule affecting less than 10 percent of the domestic

[78] See Interagency Working Group on Social Cost of Greenhouse Gases, *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide. Interim Estimates Under Executive Order 13990,* Washington, DC, February 2021. *https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.*

housing market. (MHARR, No. 154 at p. 32).

In contrast, the Joint Advocates stated that only a partial accounting of the costs of climate change (those most easily monetized) can be provided, which inevitably involves incorporating elements of uncertainty. The Joint Advocates commented that accounting for the economic harms caused by climate change is a critical component of sound cost—benefit analyses of regulations that directly or indirectly limit greenhouse gases. The Joint Advocates stated that several executive orders direct Federal agencies to consider non-economic costs and benefits, such as environmental and public health impacts. (Joint Advocates, No. 147 at pp. 2–3) Furthermore, the Joint Advocates argued that without an SC-$CO_2$ estimate, regulators would by default be using a value of zero for the benefits of reducing carbon pollution, thereby implying that carbon pollution has no costs. The Joint Advocates stated that it would be arbitrary for a Federal agency to weigh the societal benefits and costs of a rule with significant carbon pollution effects but to assign no value at all to the considerable benefits of reducing carbon pollution. (Joint Advocates, No. 147 at p. 3).

The Joint Advocates stated that assessment and use of the IAMs in developing the SC-$CO_2$ values has been transparent. The Joint Advocates further noted that the Government Accountability Office found that the IWG's processes and methods used consensus-based decision making, relied on existing academic literature and models, and took steps to disclose limitations and incorporate new information. The Joint Advocates stated that repeated opportunities for public comment demonstrate that the IWG's SC-$CO_2$ estimates were developed and are being used transparently. (Joint Advocates, No. 147 at p. 4) The Joint Advocates stated that (1) the IAMs used reflect the best available, pee*R*-reviewed science to quantify the benefits of carbon emission reductions; (2) uncertainty is not a valid reason for rejecting the SC-$CO_2$ analysis, and (3) the IWG was rigorous in addressing uncertainty inherent in estimating the economic cost of pollution. (Joint Advocates, No. 147 at pp. 5, 17–18, 18–19) The Joint Advocates added that the increase in the SC-$CO_2$ estimate in the 2013 update reflects the growing scientific and economic research on the risks and costs of climate change, but is still very likely an underestimate of the SC-$CO_2$. (Joint Advocates, No. 147 at p. 4) The Joint Advocates stated that recent research suggests that $CO_2$ fertilization is overestimated and may be canceled out by negative impacts on agriculture. (Joint Advocates, No. 147 at p. 16).

DOE emphasizes that the SC-GHG analysis presented in this SNOPR and TSD was performed in support of the cost-benefit analyses required by Executive Order 12866, and is provided to inform the public of the impacts of emissions reductions resulting from this proposed rule. The SC-GHG estimates were not factored into DOE's determination of whether the proposed rule could be cost-effective under section 413 of EISA 2007.

As noted previously, DOE has updated the SC-$CO_2$ analysis in this SNOPR using interim estimated values issued by the IWG established under Executive Order 13990. DOE has determined that the estimates from the February 2021 TSD are based upon sound analysis and provide well founded estimates for DOE's analysis of the impacts of $CO_2$ related to the reductions of emissions resulting from this proposed rule. The SC-$CO_2$ estimates used in this analysis were developed over many years, using a transparent process, peer-reviewed methodologies, the best science available at the time of that process, and with input from the public. Specifically, in 2009, an interagency working group (IWG) that included DOE and other executive branch agencies and offices was established to ensure that agencies were using the best available science and to promote consistency in the SC-$CO_2$ values used across agencies. The February 2021 TSD provides a complete discussion of the IWG's initial review conducted under E.O. 13990.

First, as the IWG affirmed, a global perspective is essential for social cost of greenhouse gases (SC-GHG) estimates because climate impacts occurring outside U.S. borders can directly and indirectly affect the welfare of U.S. citizens and residents. Thus, U.S. interests are affected by the climate impacts that occur outside U.S. borders. Examples of affected interests include: Direct effects on U.S. citizens and assets located abroad, international trade, tourism, and spillover pathways such as economic and political destabilization and global migration. In addition, assessing the benefits of U.S. GHG emissions reductions requires consideration of how those actions may affect emissions reductions by other countries, as those international actions will provide a benefit to U.S. citizens and residents by mitigating climate impacts that affect U.S. citizens and residents. Therefore, in analyzing the potential impacts of this proposed rule DOE focuses on a global measure of SC-GHG. As noted in the February 2021 TSD, the IWG will continue to review developments in the literature, including more robust methodologies for estimating SC-GHG values based on purely domestic damages, and explore ways to better inform the public of the full range of carbon impacts, both global and domestic. As a member of the IWG, DOE will likewise continue to follow developments in the literature pertaining to this issue.

Second, as the IWG found, the use of the social rate of return on capital (7 percent under current OMB Circular A–4 guidance) to discount the future benefits of reducing GHG emissions inappropriately underestimates the impacts of climate change for the purposes of estimating the SC-GHG. Consistent with the findings of the National Academies (2017) and the economic literature, the IWG continued to conclude that the consumption rate of interest is the theoretically appropriate discount rate in an intergenerational context (IWG 2010, 2013, 2016a, 2016b), and recommended that discount rate uncertainty and relevant aspects of intergenerational ethical considerations be accounted for in selecting future discount rates.

While the IWG works to assess how best to incorporate the latest, peer reviewed science to develop an updated set of SC-GHG estimates, it set the interim estimates to be the most recent estimates developed by the IWG prior to the group being disbanded in 2017. The estimates rely on the same models and harmonized inputs and are calculated using a range of discount rates. As explained in the February 2021 TSD, the IWG has determined that it is appropriate to revert to the same set of four values drawn from the SC-GHG distributions based on three discount rates as were used in regulatory analyses between 2010 and 2016 and subject to public comment. As explained in the February 2021 TSD, this update reflects the immediate need to have an operational SC-GHG for use in regulatory benefit-cost analyses and other applications that was developed using a transparent process, peer-reviewed methodologies, and the science available at the time of that process. Those estimates were subject to public comment in the context of dozens of proposed rulemakings as well as in a dedicated public comment period in 2013.

DOE acknowledges that there are a number of challenges in attempting to assess the incremental economic impacts of $CO_2$ emissions. Some uncertainties are captured within the analysis, while other areas of

uncertainty have not yet been quantified in a way that can be modeled. The February 2021 TSD presents the quantified sources of uncertainty in the form of frequency distributions, and discusses the sources of uncertainty that have not yet been quantified and are thus not reflected in these estimates. The modeling limitations do not all work in the same direction in terms of their influence on the SC-$CO_2$ estimates. However, the IWG has recommended that, taken together, the limitations suggest that the interim SC-$CO_2$ estimates used in this proposed rule likely underestimate the damages from $CO_2$ emissions. DOE agrees with the IWG's approach. Despite the limits of both quantification and monetization, SC-$CO_2$ estimates can be useful in estimating the social benefits of reducing $CO_2$ emissions. Although any numerical estimate of the benefits of reducing carbon dioxide emissions is subject to some uncertainty, that does not relieve DOE of its obligation under E.O. 12866 to attempt to factor those benefits into its cost-benefit analysis. Moreover, the IWG's SC-$CO_2$ estimates are well supported by the existing scientific and economic literature. As a result, DOE used the IWG's SC-$CO_2$ estimates in quantifying the social benefits of reducing $CO_2$ emissions. Specifically, DOE estimated the benefits from reduced (or costs from increased) emissions in any future year by multiplying the change in emissions in that year by the SC-$CO_2$ values appropriate for that year. The NPV of the benefits can then be calculated by multiplying each of these future benefits by an appropriate discount factor and summing across all affected years.

b. Monetization of Methane and Nitrous Oxide

In the June 2016 NOPR, DOE also estimated monetary benefits for $NO_X$ emissions under the proposed rule. Estimates of the monetary value of reducing $NO_X$ from stationary sources ranged from $489 to $5,023 per metric ton (2015$). DOE calculated monetary benefits using an intermediate value for $NO_X$ emissions of $2,755 per metric ton (in 2015$), and real discount rates of 3 and 7 percent. DOE received several comments on emissions monetization.

The Joint Advocates commented that DOE acknowledges that its proposed standards will reduce significant quantities of non-carbon dioxide greenhouse gases, including methane, and has estimated monetary benefits for $NO_X$ emissions under the proposed rule. The Joint Advocates commented that DOE should include the Social Cost of Methane in the estimated monetary benefits. (Joint Advocates, No. 147 at pp. 19–21) The Joint Advocates stated that the EPA and other agencies have begun using a methodology developed to specifically measure the Social Cost of Methane—namely, the Marten et al. approach [79]—in recent proposed rulemakings. This approach builds on the methodology and assumptions used by the IWG to develop the SC-$CO_2$, but also accounts for other factors that are unique to methane. Overall, the Joint Advocates commented that the Marten et al. methodology provides reasonable, direct estimates that reflect updated evidence and provide consistency with the Government's accepted methodology for estimating the SC-$CO_2$. The Joint Advocates commented that DOE should use the Social Cost of Methane to more accurately reflect the true benefits of the standards and to enhance the rigor and defensibility of the final rule.

As noted previously, DOE has updated its analysis to account for the social cost of methane and nitrous oxide consistent with the SC-$CH_4$ and SC-$N_2O$ estimates presented in the February 2021 TSD. DOE has determined that the estimates from the February 2021 TSD are based upon sound analysis and provide well founded estimates for DOE's analysis of the impacts of $CH_4$ and $NO_2$ related to the reductions of emissions resulting from this proposed rule.. The SC-$CH_4$ and SC-$N_2O$ values used for this SNOPR are presented in Table IV.28.[80] DOE multiplied the $CH_4$ and $N_2O$ emissions reduction estimated for each year by the SC-$CH_4$ and SC-$N_2O$ estimates for that year in each of the cases. To calculate a present value of the stream of monetary values, DOE discounted the values in each of the cases using the specific discount rate that had been used to obtain the SC-$CH_4$ and SC-$N_2O$ estimates in each case. See chapter 14 of the TSD for further discussion.

4. Results

a. Emissions Analysis

In this SNOPR DOE updated its analysis from the 2016 NOPR based on the results of the national energy savings discussed in section IV.C.2. DOE also updated its analysis to utilize emission factors derived from data in the *AEO 2020*.[81] The *AEO* incorporates the projected impacts of existing air quality regulations on emissions. *AEO 2020* generally represents current legislation and environmental regulations, including recent government actions, for which implementing regulations were available at the time of preparation of *AEO 2020,* including the emissions control programs discussed in the following paragraphs.[82]

$SO_2$ emissions from affected electric generating units (''EGUs'') are subject to nationwide and regional emissions cap-and-trade programs. Title IV of the Clean Air Act sets an annual emissions cap on $SO_2$ for affected EGUs in the 48 contiguous States and the District of Columbia (DC). (42 U.S.C. 7651 *et seq.*) $SO_2$ emissions from numerous eastern States and DC are also limited under the Cross-State Air Pollution Rule (''CSAPR''), which created an allowance-based trading program that operates along with the Title IV program in those States and DC. 76 FR 48208 (Aug. 8, 2011). CSAPR requires these States to reduce certain emissions, including annual $SO_2$ emissions, and went into effect as of January 1, 2015. *AEO 2020* incorporates implementation of CSAPR, including the update to the CSAPR ozone season program emission budgets and target dates issued in 2016, 81 FR 74504 (Oct. 26, 2016). Compliance with CSAPR is flexible among EGUs and is enforced through the use of tradable emissions allowances. Under existing EPA regulations, any excess $SO_2$ emissions allowances resulting from the lower electricity demand caused by the adoption of an efficiency standard could be used to permit offsetting increases in $SO_2$ emissions by another regulated EGU.

However, beginning in 2016, $SO_2$ emissions began to fall as a result of implementation of the Mercury and Air Toxics Standards (''MATS'') for power plants. 77 FR 9304 (Feb. 16, 2012). In the MATS final rule, EPA established a standard for hydrogen chloride as a surrogate for acid gas hazardous air pollutants (''HAP''), and also

[79] Marten, A.L., Kopits, E.A., Griffiths, C.W., Newbold, S.C., and A. Wolverton. 2015. Incremental $CH_4$ and $N_2O$ Mitigation Benefits Consistent with the U.S. Government's SC-CO2 Estimates. *Climate Policy.* 15(2): 272–298 (published online, 2014).

[80] See Interagency Working Group on Social Cost of Greenhouse Gases, *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide. Interim Estimates Under Executive Order 13990,* Washington, DC, February 2021. *https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.*

[81] See Energy Information Administration, Annual Energy Outlook 2020 with Projections to 2050 (2020), available at *https://www.eia.gov/outlooks/aeo/pdf/AEO2020%20Full%20Report.pdf.*

[82] For further information, see the Assumptions to *AEO2020* report that sets forth the major assumptions used to generate the projections in the Annual Energy Outlook. Available at *https://www.eia.gov/outlooks/aeo/assumptions/* (last accessed July 6, 2020).

established a standard for $SO_2$ (a non-HAP acid gas) as an alternative equivalent surrogate standard for acid gas HAP. The same controls are used to reduce HAP and non-HAP acid gas; thus, $SO_2$ emissions are being reduced as a result of the control technologies installed on coal-fired power plants to comply with the MATS requirements for acid gas. To continue operating, coal plants must have either flue gas desulfurization or dry sorbent injection systems installed. Both technologies, which are used to reduce acid gas emissions, also reduce $SO_2$ emissions. Because of the emissions reductions under the MATS, it is unlikely that excess $SO_2$ emissions allowances resulting from the lower electricity demand would be needed or used to permit offsetting increases in $SO_2$ emissions by another regulated EGU. Therefore, energy conservation standards that decrease electricity generation will generally reduce $SO_2$ emissions.

CSAPR also established limits on $NO_X$ emissions for numerous States in the eastern half of the United States. Energy conservation standards would have little effect on $NO_X$ emissions in those States covered by CSAPR emissions limits if excess $NO_X$ emissions allowances resulting from the lower electricity demand could be used to permit offsetting increases in $NO_X$ emissions from other EGUs. In such a case, $NO_X$ emissions would remain near the limit even if electricity generation goes down. A different case could possibly result, depending on the configuration of the power sector in the different regions and the need for allowances, such that $NO_X$ emissions might not remain at the limit in the case of lower electricity demand. In this case, energy conservation standards might reduce $NO_X$ emissions in covered States. Despite this possibility, DOE has chosen to be conservative in its analysis and has maintained the assumption that energy conservation standards will not reduce $NO_X$ emissions in States covered by CSAPR. Energy conservation standards would be expected to reduce $NO_X$ emissions in the States not covered by CSAPR. DOE used *AEO 2020* data to derive $NO_X$ emissions factors for the group of States not covered by CSAPR.

The MATS limit mercury emissions from power plants, but they do not include emissions caps and as such, DOE's energy conservation standards would be expected to slightly reduce Hg emissions. DOE estimated mercury emissions reduction using emissions factors based on *AEO 2020,* which incorporates the MATS.

Combustion emissions of $CH_4$ and $N_2O$ are estimated using emissions intensity factors published by the EPA.[83] The FFC upstream emissions are estimated based on the methodology described in chapter 13 of the SNOPR TSD. The upstream emissions include both emissions from fuel combustion during extraction, processing, and transportation of fuel, and ''fugitive'' emissions (direct leakage to the atmosphere) of $CH_4$ and $CO_2$.

Table IV.29 reflects the emissions reductions for both single-section and multi-section manufactured homes.

TABLE IV.29—EMISSIONS REDUCTIONS AS A RESULT OF THE SNOPR

| Pollutant | Single-section | Multi-section |
|---|---|---|
| **Tiered Standards Site Emissions Reductions** | | |
| $CO_2$ (million metric tons) | 31.7 | 67.7 |
| Hg (metric tons) | 0.063 | 0.146 |
| $NO_X$ (thousand metric tons) | 18.3 | 37.3 |
| $SO_2$ (thousand metric tons) | 12.8 | 27.7 |
| $CH_4$ (thousand metric tons) | 1.86 | 4.14 |
| $N_2O$ (thousand metric tons) | 0.35 | 0.74 |
| **Upstream Emissions Reductions** | | |
| $CO_2$ (million metric tons) | 3.1 | 6.32 |
| Hg (metric tons) | 3.42E–4 | 7.67E–04 |
| $NO_X$ (thousand metric tons) | 39.7 | 81.7 |
| $SO_2$ (thousand metric tons) | 0.32 | 0.64 |
| $CH_4$ (thousand metric tons) | 221 | 463 |
| $N_2O$ (thousand metric tons) | 0.016 | 0.033 |
| **Total Emissions Reductions** | | |
| $CO_2$ (million metric tons) | 34.8 | 74.0 |
| Hg (metric tons) | 0.064 | 0.147 |
| $NO_X$ (thousand metric tons) | 58 | 119 |
| $SO_2$ (thousand metric tons) | 13.1 | 28.3 |
| $CH_4$ (thousand metric tons) | 223 | 467 |
| $N_2O$ (thousand metric tons) | 0.37 | 0.78 |
| **Untiered Standard Site Emissions Reductions** | | |
| $CO_2$ (million metric tons) | 42.4 | 67.7 |
| Hg (metric tons) | 0.087 | 0.146 |
| $NO_X$ (thousand metric tons) | 24.0 | 37.3 |
| $SO_2$ (thousand metric tons) | 17.2 | 27.7 |
| $CH_4$ (thousand metric tons) | 2.51 | 4.14 |

[83] Available at *www2.epa.gov/climateleadership/centeR-corporate-climate-leadership-ghg-emission-factors-hub.*

TABLE IV.29—EMISSIONS REDUCTIONS AS A RESULT OF THE SNOPR—Continued

| Pollutant | Single-section | Multi-section |
|---|---|---|
| $N_2O$ (thousand metric tons) | 0.47 | 0.74 |
| **Upstream Emissions Reductions** | | |
| $CO_2$ (million metric tons) | 4.09 | 6.32 |
| Hg (metric tons) | 4.65E–04 | 7.67E–04 |
| $NO_X$ (thousand metric tons) | 52.5 | 81.7 |
| $SO_2$ (thousand metric tons) | 0.42 | 0.64 |
| $CH_4$ (thousand metric tons) | 293 | 463 |
| $N_2O$ (thousand metric tons) | 0.021 | 0.033 |
| **Total Emissions Reductions** | | |
| $CO_2$ (million metric tons) | 46.4 | 74.0 |
| Hg (metric tons) | 0.087 | 0.147 |
| $NO_X$ (thousand metric tons) | 76.5 | 119 |
| $SO_2$ (thousand metric tons) | 17.6 | 28.3 |
| $CH_4$ (thousand metric tons) | 296 | 467 |
| $N_2O$ (thousand metric tons) | 0.49 | 0.78 |

b. Monetization of Emissions

DOE estimated the global social benefits of GHG emission reductions expected from this final rule using the SC-GHG estimates presented in the *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990* (IWG 2021) that would be expected to result from the SNOPR as discussed in IV.D.2 DOE has determined that the estimates from the February 2021 TSD are based upon sound analysis and provide well founded estimates for DOE's analysis of the impacts of GHG related to the reductions of emissions resulting from this proposed rule. These SC-GHG estimates are the same as those used in the June 2016 NOPR except adjusted for inflation to 2020 dollars. Table IV. presents the global values of the $CO_2$ emissions reduction.

TABLE IV.30—PRESENT VALUE OF $CO_2$ EMISSIONS REDUCTION FOR MANUFACTURED HOMES PURCHASED 2023–2052 WITH A 30-YEAR LIFETIME

| | SC-$CO_2$ Case (million 2020$) | | | |
|---|---|---|---|---|
| | 5% discount rate, average | 3% discount rate, average | 2.5% discount rate, average | 3% discount rate, 95th percentile |
| **Tiered Standards** | | | | |
| Single Section | $259.8 | $1,173.3 | $1,963.4 | $3,614.2 |
| Multi Section | 553.6 | 2,498.8 | 4,180.3 | 7,696.9 |
| Total | 813.4 | 3,672.1 | 6,143.6 | 11,311.1 |
| **Untiered Standard** | | | | |
| Single Section | $347.1 | $1,567.0 | $2,621.9 | $4,826.8 |
| Multi Section | 553.6 | 2,498.8 | 4,180.3 | 7,696.9 |
| Total | 900.7 | 4,065.8 | 6,802.1 | 12,523.7 |

Similarly, DOE has updated the quantified total climate benefits to estimate monetary benefits likely to result from the reduced emissions of $CH_4$ and $N_2O$, consistent with the interim estimates in the February 2021 TSD. DOE multiplied the $CH_4$ and $N_2O$ emissions reduction estimated for each year by the SC-$CH_4$ and SC-$N_2O$ estimates for that year in each of the two cases. Table IV.30 presents the value of the $CH_4$ emissions reduction, and Table IV.31 presents the value of the $N_2O$ emissions reduction.

TABLE IV.30—PRESENT VALUE OF METHANE EMISSIONS REDUCTION FOR MANUFACTURED HOMES PURCHASED 2023–2052 WITH A 30-YEAR LIFETIME

[Million 2020$]

| | SC-$CH_4$ case | | | |
|---|---|---|---|---|
| | 5% discount rate, average | 3% discount rate, average | 2.5% discount rate, average | 3% discount rate, 95th percentile |
| **Tiered Standards** | | | | |
| Single Section | $83.4 | $270.4 | $401.4 | $720.2 |
| Multi Section | 175.1 | 567.3 | 842.0 | 1,511.0 |
| Total | 258.5 | 837.7 | 1,243.4 | 2,231.2 |
| **Untiered Standard** | | | | |
| Single Section | 110.9 | 359.4 | 533.5 | 957.4 |
| Multi Section | 175.1 | 567.3 | 842.0 | 1,511.0 |
| Total | 286.0 | 926.7 | 1,375.6 | 2,468.4 |

TABLE IV.31—PRESENT VALUE OF NITROUS OXIDE EMISSIONS REDUCTION FOR MANUFACTURED HOMES PURCHASED 2023–2052 WITH A 30-YEAR LIFETIME

[Million 2020$]

| | SC-$N_2O$ case | | | |
|---|---|---|---|---|
| | 5% discount rate, average | 3% discount rate, average | 2.5% discount rate, average | 3% discount rate, 95th percentile |
| **Tiered Standards** | | | | |
| Single Section | $1.12 | $4.94 | $8.15 | $13.16 |
| Multi Section | 2.35 | 10.33 | 17.04 | 27.52 |
| Total | 3.48 | 15.27 | 25.19 | 40.68 |
| **Untiered Standard** | | | | |
| Single Section | 1.49 | 6.55 | 10.81 | 17.45 |
| Multi Section | 2.35 | 10.33 | 17.04 | 27.52 |
| Total | 3.85 | 16.88 | 27.85 | 44.97 |

In this SNOPR, DOE also updated the monetization of $NO_X$ and $SO_2$ emissions reductions from both electricity generation and direct use from manufactured homes. For this analysis, DOE used linear interpolation to define values for the years between 2020 and 2025 and between 2025 and 2030; for years beyond 2030 the value is held constant. Full details of this methodology are described in chapter 14 of the SNOPR TSD. DOE multiplied the $NO_X$ and $SO_2$ emissions reduction (in tons) in each year by the associated $/ton values, and then discounted each series using discount rates of 3 percent and 7 percent as appropriate. Table IV.32 and Table IV.33 presents the results.

TABLE IV.32—PRESENT VALUE OF $NO_X$ EMISSIONS REDUCTION FOR MANUFACTURED HOMES PURCHASED 2023–2052 WITH A 30-YEAR LIFETIME

[Million 2020$]

| | 3% discount rate (high) | 7% discount rate (high) | 3% discount rate (low) | 7% discount rate (low) |
|---|---|---|---|---|
| **Tiered Standards** | | | | |
| Single Section | $338.9 | $117.9 | $149.0 | $52.4 |
| Multi Section | 676.5 | 235.6 | 297.1 | 104.8 |
| Total | 1,015.4 | 353.4 | 446.0 | 157.2 |
| **Untiered Standard** | | | | |
| Single Section | 442.9 | 154.1 | 194.6 | 68.6 |

TABLE IV.32—PRESENT VALUE OF $NO_X$ EMISSIONS REDUCTION FOR MANUFACTURED HOMES PURCHASED 2023–2052 WITH A 30-YEAR LIFETIME—Continued

[Million 2020$]

| | 3% discount rate (high) | 7% discount rate (high) | 3% discount rate (low) | 7% discount rate (low) |
|---|---|---|---|---|
| Multi Section | 676.5 | 235.6 | 297.1 | 104.8 |
| Total | 1,119.4 | 389.7 | 491.7 | 173.3 |

TABLE IV.33—PRESENT VALUE OF $SO_2$ EMISSIONS REDUCTION FOR MANUFACTURED HOMES PURCHASED 2023–2052 WITH A 30-YEAR LIFETIME

[Million 2020$]

| | 3% discount rate (high) | 7% discount rate (high) | 3% discount rate (low) | 7% discount rate (low) |
|---|---|---|---|---|
| **Tiered Standards** | | | | |
| Single Section | $549.3 | $189.3 | $240.9 | $84.8 |
| Multi Section | 1,128.6 | 387.8 | 493.8 | 174.5 |
| Total | 1,677.9 | 577.0 | 734.7 | 259.3 |
| **Untiered Standard** | | | | |
| Single Section | 723.9 | 249.2 | 317.2 | 111.8 |
| Multi Section | 1,128.6 | 387.8 | 493.8 | 174.5 |
| Total | 1,852.5 | 637.0 | 811.0 | 286.3 |

DOE has not considered the monetary benefits of the reduction of Hg for this SNOPR.

*E. Total Benefits and Costs*

DOE has tentatively determined that under either proposal the benefits to the Nation of the standards (energy savings, consumer LCC savings, positive NPV of consumer benefit, and emission reductions) outweigh the burdens (loss of INPV, LCC increases for some homeowners of manufactured housing, and price-sensitive consumers who do not purchase manufactured homes). The tentative projected total benefits and costs (from the manufactured homeowner's perspective) associated with the SNOPR, expressed in terms of annualized values, is presented in Table I.9 (See Section I.E), and is explained in greater detail in section IV and in chapter 15 of the SNOPR TSD.[84]

[84] DOE used a two-step calculation process to convert the time-series of costs and benefits into annualized values. First, DOE calculated a present value in 2016, the year used for discounting the net present value of total consumer costs and savings, for the time-series of costs and benefits using discount rates of three and seven percent for all costs and benefits except for the value of $CO_2$ reductions. From the present value, DOE then calculated the fixed annual payment over a 30-year period, starting in 2020 that yields the same present value. The fixed annual payment is the annualized value. Although DOE calculated annualized values, this does not imply that the time-series of cost and benefits from which the annualized values were determined would be a steady stream of payments.

## V. Procedural Issues and Regulatory Review

*A. Review Under Executive Orders 12866 and 13563*

Section 1(b)(1) of Executive Order (E.O.) 12866, ''Regulatory Planning and Review,'' 58 FR 51735 (Oct. 4, 1993), requires each agency to identify the problem that it intends to address, including, where applicable, the failures of private markets or public institutions that warrant new agency action, as well as to assess the significance of that problem. The problems that the proposed standards for manufactured housing are intended to address are as follows:

(1) Under current federal standards, manufactured homes typically conserve less energy than comparably built site-built and modular homes,

(2) Insufficient information and the high costs of gathering and analyzing relevant information leads some consumers to miss opportunities to make cost-effective investments in energy efficiency.

(3) In some cases, the benefits of more efficient equipment are not realized due to misaligned incentives between purchasers and users. An example of such a case is when a product or design decision is made by a building contractor or building owner who does not pay the energy costs.

(4) There are external benefits resulting from improved energy efficiency of products or equipment that are not captured by the users of such equipment. These benefits include externalities related to public health, environmental protection and national energy security that are not reflected in energy prices, such as reduced emissions of air pollutants and greenhouse gases that impact human health and global warming.

The Administrator of the Office of Information and Regulatory Affairs (''OIRA'') in the OMB has determined that the regulatory action in this document is a significant regulatory action under section (3)(f) of E.O. 12866. Accordingly, pursuant to section 6(a)(3)(B) of the E.O., DOE has provided to OIRA: (1) The text of the draft regulatory action, together with a reasonably detailed description of the need for the regulatory action and an explanation of how the regulatory action will meet that need; and (2) an assessment of the potential costs and benefits of the regulatory action, including an explanation of the manner in which the regulatory action is consistent with a statutory mandate. DOE has included these documents in the rulemaking record.

In addition, the Administrator of OIRA has determined that the regulatory action is an ''economically'' significant

regulatory action under section (3)(f)(1) of E.O. 12866. Accordingly, pursuant to section 6(a)(3)(C) of the E.O., DOE has provided to OIRA an assessment, including the underlying analysis, of benefits and costs anticipated from the regulatory action, together with, to the extent feasible, a quantification of those costs; and an assessment, including the underlying analysis, of costs and benefits of potentially effective and reasonably feasible alternatives to the planned regulation, and an explanation why the planned regulatory action is preferable to the identified potential alternatives. These assessments can be found in the technical support document for this rulemaking and are summarized in the tables below.

TABLE V.1—SUMMARY OF ECONOMIC BENEFITS AND COSTS TO MANUFACTURED HOME HOMEOWNERS UNDER THE PROPOSED STANDARDS

| Benefits | Net present value (billion 2020$) | | Discount rate (%) |
|---|---|---|---|
| | Tiered | Untiered | |
| Consumer Operating Cost Savings | $5.5 | $6.1 | 7. |
| | 14.3 | 15.9 | 3. |
| GHG Reduction (using avg. social costs at 5% discount rate) * | 1.1 | 1.2 | 5. |
| GHG Reduction (using avg. social costs at 3% discount rate) * | 4.5 | 5.0 | 3. |
| GHG Reduction (using avg. social costs at 2.5% discount rate) * | 7.4 | 8.2 | 2.5. |
| GHG Reduction (using 95th percentile social costs at 3% discount rate) * | 13.6 | 15.0 | 3. |
| $NO_X$ Reduction | 0.2 | 0.2 | 7. |
| | 0.4 | 0.5 | 3. |
| $SO_2$ Reduction | 0.3 | 0.3 | 7. |
| | 0.7 | 0.8 | 3. |
| Total Benefits | 7 to 19.5 | 7.8 to 21.6 | 7 plus GHG range. |
| | 10.5 | 11.6 | 7. |
| | 20.0 | 22.2 | 3. |
| | 16.6 to 29.1 | 18.4 to 32.2 | 3 plus GHG range. |
| Costs | | | |
| Consumer Incremental Product Costs † | 3.9 | 4.7 | 7.3 |
| | 7.9 | 9.6 | 3. |
| Total Net Benefits | | | |
| Including GHG and Emissions Reduction Monetized Value | 3.1 to 15.6 | 3 to 16.9 | 7 plus GHG range. |
| | 6.6 | 6.9 | 7. |
| | 12.1 | 12.6 | 3. |
| | 8.7 to 21.2 | 8.7 to 22.6 | 3 plus GHG range. |

**Note:** This table presents the costs and benefits associated with manufactured homes shipped in 2023–2052.

* The benefits from GHG reduction were calculated using global benefit-per-ton values. See section IV.D.2 of this document for more details.

** Total Benefits for both the 3-percent and 7-percent cases are presented using the average GHG social costs with 3-percent discount rate. In the rows labeled ''7% plus GHG range'' and ''3% plus GHG range,'' the consumer benefits and $NO_X$ and $SO_2$ benefits are calculated using the labeled discount rate, and those values are added to the GHG reduction using each of the four GHG social cost cases.

† The incremental costs include incremental costs associated with principal and interest, mortgage and property tax for the analyzed loan types.

TABLE V.2—ANNUALIZED BENEFITS AND COSTS TO MANUFACTURED HOME HOMEOWNERS UNDER THE PROPOSED STANDARDS

| Benefits | Net present value (billion 2020$) | | Discount rate (%) |
|---|---|---|---|
| | Tiered | Untiered | |
| Consumer Operating Cost Savings | 509 | 565 | 7. |
| | 774 | 859 | 3. |
| GHG Reduction (using avg. social costs at 5% discount rate)* | 70 | 77 | 5. |
| GHG Reduction (using avg. social costs at 3% discount rate)* | 231 | 256 | 3. |
| GHG Reduction (using avg. social costs at 2.5% discount rate)* | 354 | 392 | 2.5. |
| GHG Reduction (using 95th percentile social costs at 3% discount rate)* | 693 | 767 | 3. |
| $NO_X$ Reduction | 13 | 14 | 7. |
| | 23 | 25 | 3. |
| $SO_2$ Reduction | 21 | 23 | 7. |
| | 37 | 41 | 3. |
| Total Benefits | 613 to 1,236 | 679 to 1,369 | 7 plus GHG range. |
| | 773 | 858 | 7. |
| | 1,065 | 1,181 | 3. |
| | 904 to 1,527 | 1,003 to 1,693 | 3 plus GHG range. |
| Costs | | | |
| Consumer Incremental Product Costs † | 359 | 440 | 7. |

TABLE V.2—ANNUALIZED BENEFITS AND COSTS TO MANUFACTURED HOME HOMEOWNERS UNDER THE PROPOSED STANDARDS—Continued

| Benefits | Net present value (billion 2020$) | | Discount rate (%) |
|---|---|---|---|
| | Tiered | Untiered | |
| | 427 | 530 | 3. |
| Total Net Benefits | | | |
| Including GHG and Emissions Reduction Monetized Value | 254 to 877<br>414<br>638<br>477 to 1,100 | 239 to 929<br>418<br>651<br>473 to 1,163 | 7 plus GHG range.<br>7.<br>3.<br>3 plus GHG range. |

**Note:** This table presents the costs and benefits associated with manufactured homes shipped in 2023–2052.

* The benefits from GHG reduction were calculated using global benefit-per-ton values. See section IV.D of this document for more details.

** Total Benefits for both the 3-percent and 7-percent cases are presented using the average GHG social costs with 3-percent discount rate. In the rows labeled ''7% plus GHG range'' and ''3% plus GHG range,'' the consumer benefits and $NO_X$ and $SO_2$ benefits are calculated using the labeled discount rate, and those values are added to the GHG reduction using each of the four GHG social cost cases.

† The incremental costs include incremental costs associated with principal and interest, mortgage and property tax for the analyzed loan types.

DOE has also reviewed this proposed regulation pursuant to E.O. 13563, issued on January 18, 2011. 76 FR 3281 (Jan. 21, 2011). E.O. 13563 is supplemental to and explicitly reaffirms the principles, structures, and definitions governing regulatory review established in E.O. 12866. To the extent permitted by law, agencies are required by E.O. 13563 to: (1) Propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public.

DOE emphasizes as well that E.O. 13563 requires agencies to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible. In its guidance, OIRA has emphasized that such techniques may include identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes. For the reasons stated in the preamble, this proposed rule is consistent with these principles, including the requirement that, to the extent permitted by law, benefits justify costs and that net benefits are maximized.

*B. Review Under the Regulatory Flexibility Act*

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of an initial regulatory flexibility analysis (''IRFA'') and a final regulatory flexibility analysis (''FRFA'') for any rule that by law must be proposed for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by E.O. 13272, ''Proper Consideration of Small Entities in Agency Rulemaking,'' 67 FR 53461 (Aug. 16, 2002), DOE published procedures and policies on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the rulemaking process. 68 FR 7990 (Feb. 9, 2003) DOE has made its procedures and policies available on the Office of the General Counsel's website (*https://energy.gov/gc/office-general-counsel*). DOE has prepared the following updated IRFA for the products that are the subject of this rulemaking.

1. Need for, and Objectives of, the Rule

EISA requires DOE to regulate energy conservation in manufactured housing, an area of the building construction industry traditionally regulated by HUD. HUD has regulated the manufactured housing industry since 1976, when it first promulgated the HUD Code. Among other provisions, EISA directs DOE to consult with the Secretary of HUD, who may seek further counsel from the Manufactured Housing Consensus Committee (MHCC); and to base the energy conservation standards on the most recent version of the IECC, except where DOE finds that the IECC is not cost effective or where a more stringent standard would be more cost effective, based on the impact of the IECC on the purchase price of manufactured housing and on total lifecycle construction and operating costs. (42 U.S.C. 17071).

2. Significant Issues Raised in Response to the IRFA

DOE received comments from the Office of Advocacy at the U.S. Small Business Administration (''Advocacy'') and other interested parties on the manufactured housing June 2016 NOPR regarding small businesses. These comments are addressed in this section.

Advocacy stated that DOE published an IRFA that did not comply with the RFA's requirement to quantify or describe the economic impact that the proposed regulation might have on small entities. (Advocacy, No. 177 at p. 2) Advocacy stated that DOE failed to include large costs such as conversion costs and test procedure compliance costs. Advocacy also stated that compliance and enforcement costs (redesign costs, plant modifications, re-costing and sourcing new materials, inspections, approvals, consulting fees, and employee training) are major costs to small businesses and should be included and analyzed in the proposed rule (Advocacy, No. 177 at p. 3).

In the June 2016 NOPR IRFA DOE estimated the impacts on small

manufacturers based on the general industry analysis. In this updated IRFA, DOE expands its analysis to include a more detailed review of the burdens and compares costs to small manufacturer revenue to determine whether those costs are significant. DOE included product conversion costs, based on the expected number of model plans that need to be redesigned as a result of this proposed rule, and capital conversion costs, based on the cost of additional equipment needed to produce compliant homes. In the June 2016 NOPR, DOE estimated costs manufacturers would incur from test procedures as proposed in a separate rulemaking. As discussed, this SNOPR does not include cost estimates related to test procedures, as any such costs will be addressed separately. The test procedure NOPR for manufactured housing was published on November 9, 2016. 81 FR 78733.

Advocacy requested that DOE present and analyze significant alternatives, and adopt a regulatory alternative to the proposed standard that will minimize the economic impact to small manufacturers (Advocacy, No. 177 at pp. 2–4). Further, Advocacy expressed concern that the proposed rule would have a significant impact on small manufacturers. Advocacy stated it takes longer for small manufacturers to recover investments, because they must spread similar redesign investments over a lower volume of units than larger competitors. (Advocacy, No. 177 at p. 2) Additionally, MHARR commented that the proposed rule will have a particularly negative impact on the smaller producers in terms of regulatory cost burdens. (MHARR, Public Meeting Transcript, No. 148 at p. 13) The MHCC commented that DOE has not adequately addressed the impact of the proposed rule on small manufacturers, stating that small manufacturers may not be able to compete in the marketplace due to economies of scale afforded to large manufacturers that are able to purchase materials in volume at discounted rates not available to smaller manufacturers. The MHCC noted that DOE did not certify that the proposed rule would not have a significant impact on small manufacturers. (MHCC, No. 162 at p. 2).

In the June 2016 NOPR, DOE quantified the number of small businesses that have a direct compliance burden and estimated the magnitude of the compliance burden based on industry average conversion costs. In this updated IRFA, DOE expands its analysis to include a more detailed review of the burdens, an analysis of the costs specific to small manufacturers, and a comparison of these costs to small manufacturer revenue to determine whether those costs are significant. This analysis can be found in section V.B.4 of the updated IRFA. Additionally, DOE includes a review of alternatives to this proposal in section V.B.5 of the IRFA. DOE recognizes that new standards can create cost uncertainty for small businesses, but the updated analysis finds that the expected investments are less than 0.1 percent of revenues for small manufacturers (see section V.C.4). While small manufacturers may need to spread these costs over a lower volume of shipments than larger competitors, DOE finds this level of investment unlikely to change the level of industry competition or be a driver of industry consolidation.

Advocacy commented that DOE's estimate of $2,423 and $3,745 price increases for single- and multi-section manufactured homes is extremely low and does not accurately reflect the baseline cost, nor the dealer and retail markups. Advocacy expressed that even a modest increase in the price of manufactured housing will prevent many potential consumers from obtaining financing, which would severely impact small manufacturers' consumer base. Further, Advocacy stated that dominant businesses in the manufactured home industry can sell manufactured homes at cost or offer energy rebates to their consumers to offset the increased price of energy efficient homes. Advocacy stated that small businesses cannot absorb the added cost to comply with the proposed regulation. (Advocacy, No. 177 at p. 3).

In response to the June 2016 NOPR, certain parties commented that DOE's estimated incremental cost to the consumer were too low, whereas other interested parties stated that the estimates were too high (see section IV.A.1.g for a full discussion). During the June 2016 NOPR public meeting, MHI stated that it represents small manufacturers and that the cost analysis used by the MH working group included small, medium, and large manufacturers. (MHI, Public Meeting Transcript, No. 148 at pp. 85–86). DOE confirmed MHI represented multiple small manufacturers through its publicly-available manufacturer membership list.[85] Additionally, as described in section IV.A.1.g of the SNOPR, DOE took steps to validate incremental costs of production materials through published data. As a result, the incremental cost figures provided by the MH working group in the course of the negotiated consensus process are understood to be representative for manufacturers of all sizes.

MHARR stated that DOE's analysis contains financial information from 10–K filings that are likely from larger industry corporations. (MHARR, No. 154 at p. 33) Table 12.1 of the SNOPR Technical Support Document (TSD) summarizes the financial parameters DOE used in its analysis of manufacturer impacts. The Department makes uses of all public and private financial information made available. DOE invites stakeholders to provide additional financial data to be considered in the analysis.

MHARR referenced a SBA report to make the case that federal regulation generally has a disproportionately negative impact on smaller businesses in any industry. (MHARR, No. 154 at pp. 33). As noted in the NOPR, DOE recognizes that the rulemaking will have costs to small manufacturers. In this SNOPR, DOE includes a tiered proposal which is based on a tiered structure that would minimize impacts on the most cost-sensitive segment of manufactured home buyers and on the small manufacturers that serve that market segment. In the updated IRFA (see the ''Description and Estimate of Compliance Requirements'' section below), DOE estimates conversion costs of the updated proposed standard level to be $43,000 per small manufacturer, an amount that is less than 0.1% of average annual revenues.

Lastly, Advocacy recommended that DOE adopt delayed compliance schedules for small manufacturers, stating that more time to comply will allow them to spread costs and manage their limited resources in a way that will minimize the economic impact on their business. (Advocacy, No. 177 at p. 4) In this SNOPR, DOE has proposed a one-year lead time for compliance. As discussed in previous sections, a one-year lead time would allow for coordination of compliance with the DOE requirements and the HUD Code and provide manufacturers flexibility in allocating and managing the resources needed to bring their manufactured homes into compliance. Additionally, a one-year lead-time would allow for the evaluation of industry compliance under the DOE standards before DOE is required to evaluate potential updates based on the next version of the IECC.

[85] MHI Manufacturer Members. *https://www.manufacturedhousing.org/find-a-manufacturer/.*

3. Description and Estimate of the Number of Small Entities Affected

The SBA has set a size threshold for manufacturers of manufactured homes, which defines those entities classified as ''small businesses'' for the purposes of the statute. DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. (13 CFR part 121) The size standards are listed by North American Industry Classification System (NAICS) code and industry description and are available at *https://www.sba.gov/document/support--table-size-standards.* Manufacturing of manufactured housing is classified under NAICS 321991, ''Manufactured Home (Mobile Home) Manufacturing.'' The SBA sets a threshold of 1,250 employees or fewer for an entity to be considered as a small business for this category. DOE notes that the initial regulatory flexibility analysis (IRFA) in the 2016 NOPR was based on an employee threshold of 500 employees. 81 FR 42576. The updated IRFA threshold of 1,250 employee reflects the SBA's most recent guidance on the employee threshold for small businesses.

To estimate the number of companies that manufacture manufactured housing covered by this rulemaking, DOE conducted a market survey using publicly available information. DOE first attempted to identify all manufactured housing manufacturers by researching industry trade associations (*e.g.,* MHI [86]) and individual company websites. DOE used market research tools such as Hoovers reports,[87] Glassdoor,[88] and LinkedIn [89] to gather information about the number of employees and manufacturing locations. DOE also asked stakeholders and industry representatives if they were aware of any other small manufacturers. After a comprehensive list of businesses was created, DOE screened out companies that do not offer manufactured homes affected by this proposed rule, do not meet the definition of a ''small business,'' are foreign owned and operated, or do not manufacture manufactured homes in the United States.

DOE identified 34 manufacturers of manufactured housing affected by this rulemaking. Of these, DOE identified 29 as domestic small businesses.

DOE requests comment on the number of manufacturers of manufactured housing producing home covered by this rulemaking.

4. Description and Estimate of Compliance Requirements

To evaluate impacts facing manufacturers of manufactured housing, DOE estimated both the capital conversion costs (*e.g.,* investments in property, plant, and equipment) and product conversion costs (*e.g.,* expenditures on R&D, testing, marketing, and other non-depreciable expenses) manufacturers would incur to bring their manufacturing facilities and product designs into compliance with the standards as proposed.

To calculate product conversion costs, DOE estimated the number of model-plans manufacturers would need to redesign. Based on input from subject matter experts in the industry, manufacturers would need to update between 200 and 250 plans as a result of the standard. Consulting with subject matter experts in the industry, DOE estimated that each plan would require 3 hours of engineering time to update. Based on data from the Bureau of Labor Statistics, DOE calculated a fully burdened mean hourly wage for a mechanical engineer at $65.63/hour in 2020.[90] Based on these inputs, DOE estimated product conversion costs of approximately $49,000 per manufacturer.

While DOE understands most manufacturers have the necessary equipment to produce manufactured homes that are compliant with the standards as proposed in this document, DOE incorporated capital conversion costs of approximately $3,000 per manufacturer to cover additional work stations, equipment, and tooling that may be needed to support compliance with the standard.

In aggregate, DOE estimates the average small manufacturer would incur $52,000 in conversion costs. Based on data from business databases (*i.e.,* Dunn & Bradstreet and Manta), DOE estimated that small manufacturers of manufactured housing have an average annual revenue of $43.3 million. Per manufacturer conversion costs are less than 0.1 percent of average small business annual revenue. While the proposed standards would require investments on the part of small manufacturers, DOE's calculations show that the conversion costs are small relative to the size of the average small manufacturer.

DOE requests comment on the cost to update model plans and the number of model plans to update as a result of the proposed rule; on the types of equipment and capital expenditures that would be necessitated by the proposal; and the total cost of updating product offerings and manufacturing facilities. DOE requests comment on how these values would differ for small manufacturers. DOE requests comment on its estimate of average annual revenues for small manufacturers of manufactured housing.

5. Significant Alternatives Considered and Steps Taken To Minimize Significant Economic Impacts on Small Entities

In reviewing alternatives to the proposed standards, DOE examined energy conservation standards proposed in the June 2016 NOPR. The June 2016 NOPR was adopted by the MH working group, which consisted of 22 representatives of stakeholders,[91] including representatives of manufacturer trade groups that included small manufacturers. However, in response to concerns related to potential adverse impacts on price-sensitive, low-income purchasers of manufactured homes from the imposition of energy conservation standards on manufactured housing, in this SNOPR DOE is proposing the tiered standard. In the alternative, DOE is also proposing the untiered standard.

DOE evaluated the alternative of adopting a single, untiered standard for manufactured homes that focuses on the building thermal envelope, duct and air sealing, insulation installation, HVAC specifications, service hot water systems, mechanical ventilation fan efficacy, and heating and cooling equipment sizing provisions, based on the 2021 IECC. The untiered standard would apply all manufactured homes,

[86] *https://www.manufacturedhousing.org/admin/template/brochures/949temp.pdf.*

[87] Hoovers. *https://www.hoovers.com/.*

[88] *https://www.glassdoor.com/index.htm.*

[89] *https://www.linkedin.com/.*

[90] *https://www.bls.gov/oes/current/oes172141.htm.*

[91] Selected member of the MH working group were: Bert Kessler, Palm Harbor Homes, Inc.; David Tompos, NTA, Inc.; Emanuel Levy, Systems Building Research Alliance; Eric Lacey, Responsible Energy Codes Alliance; Ishbel Dickens, National Manufactured Home Owners Association (NMHOA); Keith Dennis, National Rural Electric Cooperative Association; Lois Starkey, Manufactured Housing Institute; Lowell Ungar, American Council for an Energy-Efficient Economy; Manuel Santana, Cavco Industries; Mark Ezzo, Clayton Homes, Inc.; Mark Weiss, Manufactured Housing Association for Regulatory Reform; Michael Lubliner, Washington State University Extension Energy Program; Michael Wade, Cavalier Home Builders; Peter Schneider, Efficiency Vermont; Richard Hanger, Housing Technology and Standards; Richard Potts, Virginia Department of Housing and Community Development; Rob Luter, Lippert Components, Inc.; Robin Roy, Natural Resources Defense Council; Scott Drake, East Kentucky Power Cooperative; Stacey Epperson, Next Step Network. DOE and ASRAC members were: Joseph Hagerman (DOE); and John Caskey (ASRAC, National Electrical Manufacturers Association).

regardless of manufacturer retail price. The untiered proposal is expected to result in 2.58 quads of energy savings over the 30-year analysis period.

However, DOE's primary proposal in this SNOPR is the tiered standard. DOE structured this proposal to minimize impacts on the most price-sensitive consumers and manufacturers that sell to those consumers. In the proposal, Tier 1 would apply to manufactured homes with a manufacturer's retail list price of $55,000 or less, and would incorporate building thermal envelope measures based on certain thermal envelope components subject to the 2021 IECC but would limit the incremental purchase price increase to $750 or less. The proposal also sets up a Tier 2 that would apply to manufactured homes with a manufacturer's retail list price greater than $55,000. The Tier 2 standards would be set to stringencies based on the 2021 IECC and likely increase purchase prices by more than $750. The tiered proposal is expected to result in 2.32 quads of energy savings over the 30-year analysis period. The tiered proposal balances the benefits of the energy savings with the potential burdens placed on low-income consumers and on manufacturers that serve those consumers.

*C. Review Under the Paperwork Reduction Act*

This rulemaking would not include any information collection requirements subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 *et seq.*).

*D. Review Under the National Environmental Policy Act of 1969*

DOE is preparing a draft Environmental Impact Statement (EIS) (DOE/EIS–0550) entitled, ''Environmental Impact Statement: Energy Conservation Standards for Manufactured Housing'', pursuant to the National Environmental Policy Act of 1969 (NEPA), the Council on Environmental Quality's Regulations for implementing the procedural provisions of the National Environmental Policy Act (40 CFR parts 1500–1508), and DOE's NEPA Implementing Procedures (10 CFR part 1021).

*E. Review Under Executive Order 13132*

Executive Order 13132, ''Federalism,'' 64 FR 43255 (Aug. 10, 1999) imposes certain requirements on Federal agencies formulating and implementing policies or regulations that preempt State law or that have federalism implications. The Executive order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE has examined this proposed rule and has determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government.

DOE has examined this action and has determined that it will not pre-empt State law. This action impacts energy efficiency requirements for manufacturers of manufactured homes. Therefore, no further action is required by E.O. 13132.

*F. Review Under Executive Order 12988*

With respect to the review of existing regulations and the promulgation of new regulations, section 3(a) of E.O. 12988, ''Civil Justice Reform,'' imposes on Federal agencies the general duty to adhere to the following requirements: (1) Eliminate drafting errors and ambiguity; (2) write regulations to minimize litigation; (3) provide a clear legal standard for affected conduct rather than a general standard; and (4) promote simplification and burden reduction. 61 FR 4729 (Feb. 7, 1996). Regarding the review required by section 3(a), section 3(b) of E.O. 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation: (1) Clearly specifies the preemptive effect, if any; (2) clearly specifies any effect on existing Federal law or regulation; (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction; (4) specifies the retroactive effect, if any; (5) adequately defines key terms; and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of E.O. 12988 requires Executive agencies to review regulations in light of applicable standards in section 3(a) and section 3(b) to determine whether they are met, or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, this proposed rule meets the relevant standards of E.O. 12988.

*G. Review Under the Unfunded Mandates Reform Act of 1995*

Title II of the Unfunded Mandates Reform Act of 1995 (''UMRA'') requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Public Law 104–4, section 201 (codified at 2 U.S.C. 1531). For a regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a ''significant intergovernmental mandate,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect them. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. DOE's policy statement is also available at *https://energy.gov/sites/prod/files/gcprod/documents/umra_97.pdf.*

DOE has tentatively concluded that this proposed rule may require expenditures of $100 million or more in one year by the private sector. Such expenditures may include: (1) Updates to product plans and investment in capital expenditures by manufactured home manufacturers in the years between the final rule and the compliance date of the new standards, and (2) incremental additional expenditures by consumers to purchase higher-efficiency manufactured homes, starting at the compliance date for the standards.

Section 202 of UMRA authorizes a Federal agency to respond to the content requirements of UMRA in any other statement or analysis that accompanies the rule. (2 U.S.C. 1532(c)) The content requirements of section 202(b) of UMRA relevant to a private sector mandate substantially overlap the economic analysis requirements that apply under E.O. 12866. The **SUPPLEMENTARY INFORMATION** section of this document and chapter 15 of the TSD for this SNOPR respond to those requirements.

Under section 205 of UMRA, the Department is obligated to identify and consider a reasonable number of regulatory alternatives before promulgating a rule for which a written statement under section 202 is required. (2 U.S.C. 1535(a)) DOE is required to select from those alternatives the most cost-effective and least burdensome alternative that achieves the objectives of the rule unless DOE publishes an explanation for doing otherwise, or the selection of such an alternative is inconsistent with law.

In accordance with the statutory provisions discussed in this document, this proposed rule would establish energy conservation standards for manufactured homes based on the most recent IECC, except in cases in which DOE finds that the IECC is not cost-effective, or a more stringent standard would be more cost-effective, based on the impact of the code on the purchase price of manufactured housing and on total life-cycle construction and operating costs, and taking into consideration the design and factory construction techniques of manufactured homes. (42 U.S.C. 17071(b)(1) and 42 U.S.C. 17071(b)(2)(A)) A discussion of the alternatives considered by DOE is presented in chapter 15 of the TSD for this SNOPR.

*H. Review Under the Treasury and General Government Appropriations Act, 1999*

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105–277) requires Federal agencies to issue a Family Policymaking Assessment for any rule that may affect family well-being. This proposal, if finalized as proposed, would not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment.

*I. Review Under Executive Order 12630*

Pursuant to E.O. 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights,'' 53 FR 8859 (Mar. 18, 1988), DOE has determined that this proposal, if finalized as proposed, would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

*J. Review Under the Treasury and General Government Appropriations Act, 2001*

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516, note) provides for Federal agencies to review most disseminations of information to the public under information quality guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). Pursuant to OMB Memorandum M–19–15, Improving Implementation of the Information Quality Act (April 24, 2019), DOE published updated guidelines which are available at *https://www.energy.gov/sites/prod/files/2019/12/f70/DOE%20Final%20Updated%20IQA%20Guidelines%20Dec%202019.pdf.* DOE has reviewed this proposed rule under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

*K. Review Under Executive Order 13211*

Executive Order 13211, ''Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use,'' 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OIRA at OMB, a Statement of Energy Effects for any significant energy action. A ''significant energy action'' is defined as any action by an agency that promulgates or is expected to lead to promulgation of a final rule, and that: (1) Is a significant regulatory action under E.O. 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (3) is designated by the Administrator of OIRA as a significant energy action. For any significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

DOE has tentatively concluded that this regulatory action, which proposes new energy conservation standards for manufactured housing, is not a significant energy action because the standards are not likely to have a significant adverse effect on the supply, distribution, or use of energy, nor has it been designated as such by the Administrator at OIRA. Accordingly, DOE has not prepared a Statement of Energy Effects on this proposed rule.

*L. Information Quality*

On December 16, 2004, OMB, in consultation with the Office of Science and Technology Policy (OSTP), issued its Final Information Quality Bulletin for Peer Review (the Bulletin). 70 FR 2664 (Jan. 14, 2005). The Bulletin establishes that certain scientific information shall be peer-reviewed by qualified specialists before it is disseminated by the Federal Government, including influential scientific information related to agency regulatory actions. The purpose of the Bulletin is to enhance the quality and credibility of the Government's scientific information. Under the Bulletin, the energy conservation standards rulemaking analyses are ''influential scientific information,'' which the Bulletin defines as ''scientific information the agency reasonably can determine will have, or does have, a clear and substantial impact on important public policies or private sector decisions.'' 70 FR 2664, 2667.

In response to OMB's Bulletin, DOE conducted formal peer reviews of the energy conservation standards development process for consumer products and industrial equipment under EPCA and the analyses that are typically used and prepared a report describing that peer review.[92] Generation of this report involved a rigorous, formal, and documented evaluation using objective criteria and qualified and independent reviewers to make a judgment as to the technical, scientific, and business merit; the actual or anticipated results; and the productivity and management effectiveness of programs and/or projects. While the energy conservation standards for manufactured housing in this document have been proposed pursuant to section 413 of EISA (42 U.S.C. 17071) as compared to the appliance standards authority in EPCA (42 U.S.C. 6291–6317), DOE relied on the general analytical process developed and peer-reviewed for the appliance standards. DOE conducted formal in-progress peer reviews of the energy conservation standards development process and analyses under the Appliance Standards Program and has prepared a Peer Review Report pertaining to the energy conservation standards rulemaking analyses. Generation of this report involved a rigorous, formal, and documented evaluation using objective criteria and qualified and independent reviewers to make a judgment as to the technical/scientific/business merit, the actual or anticipated results, and the productivity and management effectiveness of

[92] The 2007 ''Energy Conservation Standards Rulemaking Peer Review Report'' is available at the following website: *https://energy.gov/eere/buildings/downloads/energy-conservation-standards-rulemaking-peeR-review-report-0.*

programs and/or projects. The ''Energy Conservation Standards Rulemaking Peer Review Report'' dated February 2007 has been disseminated and is available at the following website: *https://www.energy.gov/eere/buildings/peer-review.* DOE also has a peer review in process with the National Academy of Sciences and will review any recommendations made therein when the report is available.

*M. Materials Incorporated by Reference*

Under section 301 of the Department of Energy Organization Act (Pub. L. 95–91; 42 U.S.C. 7101), DOE must comply with section 32 of the Federal Energy Administration Act of 1974, as amended by the Federal Energy Administration Authorization Act of 1977. (15 U.S.C. 788; FEAA) Section 32 essentially provides in relevant part that, where a proposed rule authorizes or requires use of commercial standards, the notice of proposed rulemaking must inform the public of the use and background of such standards. In addition, section 32(c) requires DOE to consult with the Attorney General and the FTC Chairman concerning the impact of the commercial or industry standards on competition.

DOE is proposing to incorporate by reference the industry standard published by ACCA, titled *Manual J—Residential Load Calculation (8th Edition).* ACCA Manual J is an industry accepted standard for calculating the heating and cooling load associated with a building. DOE is proposing to require building heating and cooling loads to be calculated (for purposes of equipment sizing) in accordance with ACCA Manual J. ACCA Manual J is readily available on ACCA's website at *www.acca.org/.*

DOE is proposing to incorporate by reference the industry standard published by ACCA, titled *Manual S—Residential Equipment Selection (2nd Edition).* ACCA Manual S is an industry accepted standard for calculating the appropriate heating and cooling equipment size for a building. DOE is proposing to require building heating and cooling equipment to be sized in accordance with ACCA Manual S. ACCA Manual S is readily available on ACCA's website at *www.acca.org/.*

DOE is proposing to incorporate by reference the industry standard written by C.C Conner and Z.T. Taylor of Pacific Northwest Laboratory, titled *Overall U-Values and Heating/Cooling Loads—Manufactured Homes.* This industry standard (referred to as the ''Battelle Method'') is an industry accepted method for calculating the overall thermal transmittance of a manufactured home. In instances in which manufacturers demonstrate compliance with the overall thermal transmittance requirement, DOE is proposing to require manufactured housing manufacturers to calculate the overall thermal transmittance of a manufactured home in accordance with this industry standard. This standard is readily available on the U.S. Department of Housing and Urban Development's website at *www.huduser.org/portal/publications/manufhsg/uvalue.html.*

DOE has evaluated these standards and was unable to conclude whether they fully comply with the requirements of section 32(b) of the FEAA (*i.e.,* whether they were developed in a manner that fully provides for public participation, comment, and review). DOE will consult with both the Attorney General and the Chairman of the FTC concerning the impact of these standards on competition, prior to prescribing a final rule.

## VI. Public Participation

*A. Participation in the Webinar*

The time and date of the webinar meeting are listed in the **DATES** section at the beginning of this document. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website: *https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=64.* Participants are responsible for ensuring their systems are compatible with the webinar software.

*B. Procedure for Submitting Prepared General Statements for Distribution*

Any person who has an interest in the topics addressed in this SNOPR, or who is representative of a group or class of persons that has an interest in these issues, may request an opportunity to make an oral presentation at the webinar. Requests should be sent by email to: *ApplianceStandardsQuestions@ee.doe.gov.* Persons who wish to speak should include with their request a computer file in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format that briefly describes the nature of their interest in this rulemaking and the topics they wish to discuss. Such persons should also provide a daytime telephone number where they can be reached.

Persons requesting to speak should briefly describe the nature of their interest in this rulemaking and provide a telephone number for contact. DOE requests persons selected to make an oral presentation to submit an advance copy of their statements at least two weeks before the webinar. At its discretion, DOE may permit persons who cannot supply an advance copy of their statement to participate, if those persons have made advance alternative arrangements with the Building Technologies Office. As necessary, requests to give an oral presentation should ask for such alternative arrangements.

*C. Conduct of the Webinar*

DOE will designate a DOE official to preside at the webinar and may also use a professional facilitator to aid discussion. The meeting will not be a judicial or evidentiary-type public hearing, but DOE will conduct it in accordance with section 336 of EPCA (42 U.S.C. 6306). A court reporter will be present to record the proceedings and prepare a transcript. DOE reserves the right to schedule the order of presentations and to establish the procedures governing the conduct of the webinar. There shall not be discussion of proprietary information, costs or prices, market share, or other commercial matters regulated by U.S. anti-trust laws. After the webinar and until the end of the comment period, interested parties may submit further comments on the proceedings and any aspect of the rulemaking.

The webinar will be conducted in an informal, conference style. DOE will present summaries of comments received before the webinar, allow time for prepared general statements by participants, and encourage all interested parties to share their views on issues affecting this rulemaking. Each participant will be allowed to make a general statement (within time limits determined by DOE), before the discussion of specific topics. DOE will permit, as time permits, other participants to comment briefly on any general statements.

At the end of all prepared statements on a topic, DOE will permit participants to clarify their statements briefly. Participants should be prepared to answer questions by DOE and by other participants concerning these issues. DOE representatives may also ask questions of participants concerning other matters relevant to this rulemaking. The official conducting the webinar will accept additional comments or questions from those attending, as time permits. The presiding official will announce any further procedural rules or modification of the above procedures that may be

needed for the proper conduct of the webinar.

A transcript of the webinar will be included in the docket, which can be viewed as described in the Docket section at the beginning of this SNOPR. In addition, any person may buy a copy of the transcript from the transcribing reporter.

*D. Submission of Comments*

DOE will accept comments, data, and information regarding this proposed rule no later than the date provided in the **DATES** section at the beginning of this proposed rule. Interested parties may submit comments, data, and other information using any of the methods described in the **ADDRESSES** section at the beginning of this document.

*Submitting comments via https://www.regulations.gov.* The *https://www.regulations.gov* web page will require you to provide your name and contact information. Your contact information will be viewable to DOE Building Technologies staff only. Your contact information will not be publicly viewable except for your first and last names, organization name (if any), and submitter representative name (if any). If your comment is not processed properly because of technical difficulties, DOE will use this information to contact you. If DOE cannot read your comment due to technical difficulties and cannot contact you for clarification, DOE may not be able to consider your comment.

However, your contact information will be publicly viewable if you include it in the comment itself or in any documents attached to your comment. Any information that you do not want to be publicly viewable should not be included in your comment, nor in any document attached to your comment. Otherwise, persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

Do not submit to *https://www.regulations.gov* information for which disclosure is restricted by statute, such as trade secrets and commercial or financial information (hereinafter referred to as Confidential Business Information (CBI)). Comments submitted through *https://www.regulations.gov* cannot be claimed as CBI. Comments received through the website will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section.

DOE processes submissions made through *https://www.regulations.gov* before posting. Normally, comments will be posted within a few days of being submitted. However, if large volumes of comments are being processed simultaneously, your comment may not be viewable for up to several weeks. Please keep the comment tracking number that *https://www.regulations.gov* provides after you have successfully uploaded your comment.

*Submitting comments via email.* Comments and documents submitted via email also will be posted to *https://www.regulations.gov.* If you do not want your personal contact information to be publicly viewable, do not include it in your comment or any accompanying documents. Instead, provide your contact information in a cover letter. Include your first and last names, email address, telephone number, and optional mailing address. The cover letter will not be publicly viewable as long as it does not include any comments.

Include contact information each time you submit comments, data, documents, and other information to DOE. No telefacsimiles (faxes) will be accepted.

Comments, data, and other information submitted to DOE electronically should be provided in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format. Provide documents that are not secured, that are written in English, and that are free of any defects or viruses. Documents should not contain special characters or any form of encryption and, if possible, they should carry the electronic signature of the author.

*Campaign form letters.* Please submit campaign form letters by the originating organization in batches of between 50 to 500 form letters per PDF or as one form letter with a list of supporters' names compiled into one or more PDFs. This reduces comment processing and posting time.

*Confidential Business Information.* Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email two well-marked copies: One copy of the document marked ''confidential'' including all the information believed to be confidential, and one copy of the document marked ''non-confidential'' with the information believed to be confidential deleted. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

It is DOE's policy that all comments may be included in the public docket, without change and as received, including any personal information provided in the comments (except information deemed to be exempt from public disclosure).

*E. Issues on Which DOE Requests Comment*

Although DOE welcomes comments on any aspect of this proposal, DOE is particularly interested in receiving comments and views of interested parties concerning the following issues:

1. DOE invites comment on whether (1) the manufacturer's retail list price threshold for Tier 1 under the tiered proposal is appropriate, (2) the untiered proposal in this SNOPR is cost-effective, generally, and (3) the untiered proposal is cost-effective for low-income consumers.

2. DOE welcomes comment on approaches for testing, compliance and enforcement provisions for the proposed standards and alternative proposal. DOE also welcomes comments and information related to potential testing, compliance and enforcement under the current HUD inspection and enforcement process, and potential costs of testing, compliance and enforcement of the proposed standards and alternative proposal in this document.

3. DOE requests comment on the use of a tiered approach to address affordability and PBP concerns from HUD, other stakeholders, and the policies outlined in Executive Order 13985. DOE also requests comment regarding whether the price point boundary between the proposed tiers is appropriate, and if not, at what price point should it be set and the basis for any alternative price points. DOE also requests comment on its assumptions regarding the use of high-priced loans (*e.g.,* chattel loans) by low-income purchasers, or other purchasers, of manufactured housing.

4. DOE also requests comment on alternate thresholds (besides price point) to consider for the tiered approach, including a size-based threshold (*e.g.,* square footage or whether a home is single- or multi-section). DOE requests comment on the square footage and region versus sales price data provided in the notice (from MHS PUF 2019) and how that data (or more recent versions of that data) could be used to create either a size-based or region-based threshold instead. DOE further requests input on whether there should be single national threshold as proposed, or whether it should vary based on geography or other factors, and if so, what factors should be considered.

5. DOE requests comment on using the AEO GDP deflator series to adjust the manufacturer's retail list price threshold for inflation. DOE requests comment on whether other time series, including those that account for regional variability, should be used to adjust manufacturer's retail list price.

6. DOE requests comment on whether a one-year lead time would be sufficient given potential constraints that compliance with the DOE standards may initially place on the HUD certification process, and whether a longer lead time (*e.g.,* a three-year lead time) or some other alternative lead-time for this first set of standards (*e.g.,* phased-in over three years, with one-year lead-times thereafter) should be provided.

7. DOE requests comment on its understanding of the definitional changes in the 2018 IECC and the 2021 IECC. DOE also requests comments on its changes to the proposed definitions as compared to those proposed in the June 2016 NOPR.

8. DOE requests comment on incorporating by reference ACCA Manual J, ACCA Manual S, and ''Overall U-Values and Heating/Cooling Loads—Manufactured Homes'' by Conner and Taylor.

9. DOE requests comment on basing the climate zones on the three HUD zones instead of the June 2016 NOPR-proposed four climate zones, or other configuration of climate zones. DOE further requests input on whether energy efficiency requirements should be based on smaller geographic areas than provided with the 3 or 4 zone model.

10. DOE requests comment on the Tier 1 energy conservation standards, which would be applicable to manufactured homes with a manufacturer's retail list price of $55,000 or less. DOE also requests comment on the proposed energy conservation standards based on the most recent version of the IECC for the Tier 2 and untiered standards and the consideration of R–21 sensitivity for exterior wall insulation for climate zones 2 and 3.

11. DOE requests comment on the additional energy efficiency requirements from the 2021 IECC and whether they should apply to manufactured homes, including those that DOE has initially considered as not applicable to manufactured homes. If so, DOE requests comment on how these requirements would apply and the costs and savings associated with these requirements.

12. DOE requests comment on the proposal to not require that exterior ceiling insulation must have uniform thickness or a uniform density.

13. DOE requests comment on the proposal not to limit the total area of glazed fenestration.

14. DOE requests comment on removing the proposed requirement that exterior floor insulation installed must maintain permanent contact with the underside of the rough floor decking.

15. DOE requests comment on the proposed updates to the installation of insulation criteria as it applies to manufactured homes construction only.

16. DOE requests comments on whether there are any of the 2021 IECC updates relevant to manufactured housing that should be considered as part of this rulemaking. Specifically, DOE requests comment on whether the 2021 IECC updates for installation criteria for access hatches and doors, baffles and shafts are applicable to manufactured housing and should be considered in this rulemaking.

17. DOE requests comment on the proposed updates to the air barrier criteria as it applies to manufactured homes construction only. Further, DOE requests comment whether the SNOPR proposal continues to be designed to achieve air leakage sealing requirements of 5 ACH.

18. DOE requests comments on whether there are any of the 2021 IECC updates relevant to manufactured housing that should be considered as part of this rulemaking. Specifically, DOE requests comment on whether the 2021 IECC updates for air barrier criteria for recessed lighting, narrow cavities and plumbing are applicable to manufactured housing and should be considered in this rulemaking. If so, DOE requests comment on whether the requirements would alter the 5 ACH designation.

19. DOE requests comment on the proposal to require that total air leakage of duct systems for all manufactured homes is to be less than or equal to 4 cfm per 100 square feet of conditioned floor area.

20. DOE requests comment on DOE's interpretation of R403.1 and the proposed updates to the thermostat and controls requirements. In addition, DOE requests comments on whether there are any of the 2021 IECC updates relevant to manufactured housing that should be considered as part of this rulemaking.

21. DOE requests comment on DOE's interpretation of R403.5 and the proposed updates to the service hot water requirements. In addition, DOE requests comments on whether there are any of the 2021 IECC updates relevant to manufactured housing that should be considered as part of this rulemaking. Specifically, DOE requests comment on whether the circulating hot water system temperature limit should be included as a requirement.

22. DOE requests comment on the proposal to include the 2021 IECC fan efficacy standard requirements. DOE requests comment on whether any of the fan efficacy requirements are not applicable to manufactured homes.

23. DOE requests comment on whether the HRV and ERV provisions under 2021 IECC for site-built homes are applicable to manufactured homes and whether they would be cost-effective. Specifically, DOE requests comment on costs for the HRV and ERV requirements as it applies to manufactured homes in all climate zones.

24. DOE requests comment on the above ventilation strategies, including (but not limited to) cost, performance, noise, and any other important attributes that DOE should consider, including those related to mitigation measures. While the alternate ventilation approaches are not integrated into the analysis presented as part of this proposal, DOE is giving serious consideration as to whether it should incorporate one or more of these options as part of its final rule based on any additional data and public comments it receives.

25. DOE requests comment on the cost-effectiveness and feasibility of requiring R–20+5 for the exterior wall insulation for climate zone 2 and 3 Tier 2/Untiered manufactured homes. DOE also requests comment on the sensitivity analysis for R–21 that would result in positive LCC savings for all cities.

26. DOE requests comment on the inputs to the conversion cost estimates.

27. DOE requests comment on the shipment breakdown per tier and using a substitution effect of 20 percent on shipments to account for the shift in homes sold to the lower tiered standard. DOE requests comment on whether it should use a different substitution effect value for this analysis—and if so, why. (Please provide data in support of an alternative substitution effect value.)

28. DOE requests comment on the calculation of deadweight loss presented above and the extent to which there are market failures in the no-standards case.

29. DOE requests comment on the number of manufacturers of manufactured housing producing home covered by this rulemaking.

30. DOE requests comment on the cost to update model plans and the number of model plans to update as a result of the proposed rule; on the types of equipment and capital expenditures that would be necessitated by the proposal;

and the total cost of updating product offerings and manufacturing facilities. DOE requests comment on how these values would differ for small manufacturers. DOE requests comment on its estimate of average annual revenues for small manufacturers of manufactured housing.

## VII. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this notice of proposed rulemaking.

## List of Subjects in 10 CFR Part 460

Administrative practice and procedure, Buildings and facilities, Energy conservation, Housing standards, Incorporation by reference, Reporting and recordkeeping requirements.

## Signing Authority

This document of the Department of Energy was signed on August 12, 2021, by Kelly Speakes-Backman, Principal Deputy Assistant Secretary and Acting Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the **Federal Register**.

Signed in Washington, DC, on August 13, 2021.

**Treena V. Garrett,**

*Federal Register Liaison Officer, U.S. Department of Energy.*

For the reasons stated in the preamble, DOE proposes to add part 460 of chapter II of title 10, Code of Federal Regulations as set forth below:

# PART 460—ENERGY CONSERVATION STANDARDS FOR MANUFACTURED HOMES

### Subpart A—General

Sec.



### Subpart B—Building Thermal Envelope



### Subpart C—HVAC, Service Hot Water, and Equipment Sizing



**Authority:** 42 U.S.C. 17071; 42 U.S.C. 7101 *et seq.*

## Subpart A—General

### § 460.1 Scope.

This subpart establishes energy conservation standards for manufactured homes as manufactured at the factory, prior to distribution in commerce for sale or installation in the field. A manufactured home that is manufactured on or after (date 1 year after the publication date of the final rule amending standards for manufactured homes) must comply with all applicable requirements of this part.

### § 460.2 Definitions.

Adapted from Section R202 of the 2021 IECC and as used in this part—

*Access (to)* means that which enables a device, appliance or equipment to be reached by ready access or by a means that first requires the removal or movement of a panel or similar obstruction.

*Air barrier* means one or more materials joined together in a continuous manner to restrict or prevent the passage of air through the building thermal envelope and its assemblies.

*Automatic* means self-acting or operating by its own mechanism when actuated by some impersonal influence.

*Building thermal envelope* means exterior walls, exterior floors, exterior ceiling, or roofs, and any other building element assemblies that enclose conditioned space or provide a boundary between conditioned space and unconditioned space.

*Ceiling* means an assembly that supports and forms the overhead interior surface of a building or room that covers its upper limit and is horizontal or tilted at an angle less than 60 degrees (1.05 rad) from horizontal.

*Climate zone* means a geographical region identified in § 460.101.

*Conditioned space* means an area, room, or space that is enclosed within the building thermal envelope and that is directly or indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate through openings with conditioned space, where they are separated from conditioned spaces by uninsulated walls, floors or ceilings, or where they contain uninsulated ducts, piping, or other sources of heating or cooling.

*Continuous air barrier* means a combination of materials and assemblies that restrict or prevent the passage of air from conditioned space to unconditioned space.

*Door* means an operable barrier used to block or allow access to an entrance of a manufactured home.

*Dropped ceiling* means a secondary nonstructural ceiling, hung below the exterior ceiling.

*Dropped soffit* means a secondary nonstructural ceiling that is hung below the exterior ceiling and that covers only a portion of the ceiling.

*Duct* means a tube or conduit, except an air passage within a self-contained system, utilized for conveying air to or from heating, cooling, or ventilating equipment.

*Duct system* means a continuous passageway for the transmission of air that, in addition to ducts, includes duct fittings, dampers, plenums, fans, and accessory air-handling equipment and appliances.

*Eave* means the edge of the roof that overhangs the face of an exterior wall and normally projects beyond the side of the manufactured home.

*Equipment* includes material, devices, fixtures, fittings, or accessories both in the construction of, and in the plumbing, heating, cooling, and electrical systems of a manufactured home.

*Exterior ceiling* means a ceiling that separates conditioned space from unconditioned space.

*Exterior floor* means a floor that separates conditioned space from unconditioned space.

*Exterior wall* means a wall, including a skylight well, that separates conditioned space from unconditioned space.

*Fenestration* means vertical fenestration and skylights.

*Floor* means a horizontal assembly that supports and forms the lower interior surface of a building or room upon which occupants can walk.

*Glazed or glazing* means an infill material, including glass, plastic, or other transparent or translucent material used in fenestration.

*Heated water circulation system* means a water distribution system in which one or more pumps are operated in the service hot water piping to circulate heated water from the water heating equipment to fixtures and back to the water heating equipment.

*2021 IECC* means the 2021 version of the International Energy Conservation

Code, issued by the International Code Council.

*Insulation* means material deemed to be insulation under 16 CFR 460.2.

*Manufactured home* means a structure, transportable in one or more sections, which in the traveling mode is 8 body feet or more in width or 40 body feet or more in length or which when erected onsite is 320 or more square feet, and which is built on a permanent chassis and designed to be used as a dwelling with or without a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air conditioning, and electrical systems contained in the structure. This term includes all structures that meet the above requirements except the size requirements and with respect to which the manufacturer voluntarily files a certification pursuant to 24 CFR 3282.13 and complies with the construction and safety standards set forth in 24 CFR part 3280. The term does not include any self-propelled recreational vehicle. Calculations used to determine the number of square feet in a structure will be based on the structure's exterior dimensions, measured at the largest horizontal projections when erected on site. These dimensions will include all expandable rooms, cabinets, and other projections containing interior space, but do not include bay windows. Nothing in this definition should be interpreted to mean that a manufactured home necessarily meets the requirements of the U.S. Department of Housing and Urban Development Minimum Property Standards (HUD Handbook 4900.1) or that it is automatically eligible for financing under 12 U.S.C. 1709(b).

*Manufacturer* means any person engaged in the factory construction or assembly of a manufactured home, including any person engaged in importing manufactured homes for resale.

*Manual* means capable of being operated by personal intervention.

*Opaque door* means a door that is not less than 50 percent opaque in surface area.

*R-value (thermal resistance)* means the inverse of the time rate of heat flow through a body from one of its bounding surfaces to the other surface for a unit temperature difference between the two surfaces, under steady state conditions, per unit area ($h \times ft^2 \times °F/Btu$).

*Rough opening* means an opening in the exterior wall or roof, sized for installation of fenestration.

*Service hot water* means supply of hot water for purposes other than comfort heating.

*Skylight* means glass or other transparent or translucent glazing material, including framing materials, installed at an angle less than 60 degrees (1.05 rad) from horizontal, including unit skylights, tubular daylighting devices, and glazing materials in solariums, sunrooms, roofs and sloped walls.

*Skylight well* means the exterior walls underneath a skylight that extend from the interior finished surface of the exterior ceiling to the exterior surface of the location to which the skylight is attached.

*Solar heat gain coefficient (SHGC)* means the ratio of the solar heat gain entering a space through a fenestration assembly to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation that is then reradiated, conducted, or convected into the space.

*State* means each of the 50 states, the District of Columbia, the Commonwealth of Puerto Rico, Guam, the U.S. Virgin Islands, and American Samoa.

*Thermostat* means an automatic control device used to maintain temperature at a fixed or adjustable set point.

*U-factor (thermal transmittance)* means the coefficient of heat transmission (air to air) through a building component or assembly, equal to the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films ($Btu/h \times ft^2 \times °F$).

*$U_o$ (overall thermal transmittance)* means the coefficient of heat transmission (air to air) through the building thermal envelope, equal to the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films ($Btu/h \times ft^2 \times °F$).

*Ventilation* means the natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

*Vertical fenestration* means windows (fixed or moveable), opaque doors, glazed doors, glazed block and combination opaque and glazed doors composed of glass or other transparent or translucent glazing materials and installed at a slope of greater than or equal to 60 degrees (1.05 rad) from horizontal.

*Wall* means an assembly that is vertical or tilted at an angle equal to greater than 60 degrees (1.05 rad) from horizontal that encloses or divides an area of a building or room.

*Whole-house mechanical ventilation system* means an exhaust system, supply system, or combination thereof that is designed to mechanically exchange indoor air with outdoor air when operating continuously or through a programmed intermittent schedule.

*Window* means glass or other transparent or translucent glazing material, including framing materials, installed at an angle greater than 60 degrees (1.05 rad) from horizontal.

*Zone* means a space or group of spaces within a manufactured home with heating or cooling requirements that are sufficiently similar so that desired conditions can be maintained using a single controlling device.

**§ 460.3 Materials incorporated by reference.**

Certain material is incorporated by reference into this subpart with the approval of the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in this section, DOE must publish a document in the **Federal Register** and the material must be available to the public. All approved material is available for inspection at the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, Sixth Floor, 950 L'Enfant Plaza SW, Washington, DC 20024, (202) 586–2945, *https://www.energy.gov/eere/buildings/appliance-and-equipment-standards-program,* and may be obtained from the other sources in this section. It is also available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, email: *fr.inspection@nara.gov,* or go to: *www.archives.gov/federal-register/cfr/ibr-locations.html.*

(a) *ACCA.* Air Conditioning Contractors of America, Inc., 2800 S. Shirlington Road, Suite 300, Arlington, VA 22206, 703–575–4477, *www.acca.org/.*

(1) ANSI/ACCA 2 Manual J–2016 (''ACCA Manual J''), *Manual J–Residential Load Calculation (8th edition),* Copyright 2016. IBR approved for § 460.205.

(2) ANSI/ACCA 3 Manual S–2014 (''ACCA Manual S''), *Manual S–Residential Equipment Selection (2nd Edition),* Copyright 2014. IBR approved for § 460.205.

(b) *PNL.* Pacific Northwest Laboratory, Richland, WA 99352, 800–245–2691, *www.huduser.org/portal/publications/manufhsg/uvalue.html.*

(1) PNL–8006, (''Overall *U*-values and Heating/Cooling Loads—Manufactured Homes''), *Overall U-Values and Heating/Cooling Loads—Manufactured Homes,* C.C. Conner and Z.T. Taylor,

February 1, 1992. IBR approved for § 460.102(d)(1).

(2) [Reserved].

**§ 460.4 Energy conservation standards.**

(a) *General.* Energy conservation standard tier thresholds presented in paragraphs (b) and (c) of this section must be adjusted to the most recently available Annual Energy Outlook (AEO) gross domestic product (GDP) time series.

(b) *Tier 1.* A manufactured home for which the manufacturer's retail list price is $55,000 or less in real 2019$ (*i.e.,* a Tier 1 manufactured home) must comply with all applicable requirements in subparts B and C of this part.

(c) *Tier 2.* A manufactured home for which the manufacturer retail list price is greater than $55,000 in real 2019$ (*i.e.,* a Tier 2 manufactured home) must comply with all applicable requirements in subparts B and C of this part.

## Subpart B—Building Thermal Envelope

**§ 460.101 Climate zones.**

Manufactured homes subject to the requirements of this subpart must comply with the requirements applicable to one or more of the climate zones set forth in Figure 460.101 and Table 460.101 of this section.

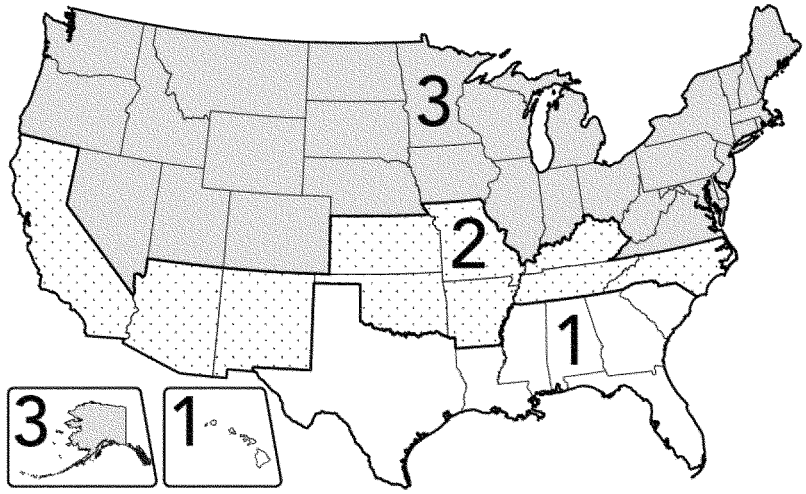


**Figure 460.101 Climate Zones**

TABLE 460.101—U.S. STATES AND TERRITORIES PER CLIMATE ZONE

| Zone 1 | Zone 2 | Zone 3 |
|---|---|---|
| Alabama | Arkansas | Alaska |
| American Samoa | Arizona | Colorado |
| Florida | California | Connecticut |
| Georgia | Kansas | Delaware |
| Guam | Kentucky | District of Columbia |
| Hawaii | Missouri | Idaho |
| Louisiana | New Mexico | Illinois |
| Mississippi | North Carolina | Indiana |
| South Carolina | Oklahoma | Iowa |
| Texas | Tennessee | Maine |
| The Commonwealth of | | Maryland |
| Puerto Rico | | Massachusetts |
| U.S. Virgin Islands | | Michigan |
| | | Minnesota |
| | | Montana |
| | | Nebraska |
| | | Nevada |
| | | New Hampshire |
| | | New Jersey |
| | | New York |
| | | North Dakota |
| | | Ohio |
| | | Oregon |
| | | Pennsylvania |
| | | Rhode Island |
| | | South Dakota |
| | | Utah |
| | | Vermont |
| | | Virginia |
| | | Washington |
| | | West Virginia |

TABLE 460.101—U.S. STATES AND TERRITORIES PER CLIMATE ZONE—Continued

| Zone 1 | Zone 2 | Zone 3 |
|---|---|---|
| | | Wisconsin<br>Wyoming |

**§ 460.102 Building thermal envelope requirements.**

(a) *Compliance options.* The building thermal envelope must meet either the prescriptive requirements of paragraph (b) of this section or the performance requirements of paragraph (c) of this section.

(b) *Prescriptive requirements.* (1) The building thermal envelope must meet the applicable minimum *R*-value, and the maximum *U*-factor and SHGC, requirements set forth in Tables 460.102–1 and 460.102–2 of this section.

TABLE 460.102–1—TIER 1 BUILDING THERMAL ENVELOPE PRESCRIPTIVE REQUIREMENTS

| Climate zone | Exterior wall insulation *R*-value | Exterior ceiling insulation *R*-value | Exterior floor insulation *R*-value | Window *U*-factor | Skylight *U*-factor | Door *U*-factor | Glazed fenestration SHGC |
|---|---|---|---|---|---|---|---|
| 1 | 13 | 22 | 22 | 1.08 | 0.75 | 0.40 | 0.7 |
| 2 | 13 | 22 | 19 | 0.5 | 0.55 | 0.40 | 0.6 |
| 3 | 19 | 22 | 22 | 0.35 | 0.55 | 0.40 | Not applicable. |

TABLE 460.102–2—TIER 2 BUILDING THERMAL ENVELOPE PRESCRIPTIVE REQUIREMENTS

| Climate zone | Exterior wall insulation *R*-value | Exterior ceiling insulation *R*-value | Exterior floor insulation *R*-value | Window *U*-factor | Skylight *U*-factor | Door *U*-factor | Glazed fenestration SHGC |
|---|---|---|---|---|---|---|---|
| 1 | 13 | 30 | 13 | 0.32 | 0.75 | 0.40 | 0.33 |
| 2 | 20+5 | 30 | 19 | 0.30 | 0.55 | 0.40 | 0.25 |
| 3 | 20+5 | 38 | 30 | 0.30 | 0.55 | 0.40 | Not applicable. |

(2) For the purpose of compliance with the exterior ceiling insulation *R*-value requirement of paragraph (b)(1) of this section, the truss heel height must be a minimum of 5.5 inches at the outside face of each exterior wall.

(3) A combination of *R*-21 batt insulation and *R*-14 blanket insulation may be used for the purpose of compliance with the floor insulation *R*-value requirement of Table 460.102–2, climate zone 3.

(4) An individual skylight that has an SHGC that is less than or equal to 0.30 is not subject to the glazed fenestration SHGC requirements established in paragraph (b)(1) of this section. Adapted from section R402 of the 2021 IECC.

(5) *U*-factor alternatives to *R*-value requirements. Compliance with the applicable requirements in paragraph (b)(1) of this section may be determined using the maximum *U*-factor values set forth in Tables 460.102–3 and 460.102–4, which reflect the thermal transmittance of the component, excluding fenestration, and not just the insulation of that component, as an alternative to the minimum *R*-value requirements set forth in Tables 460.102–1 and 460.102–2, respectively.

TABLE 460.102–3—*U*-FACTOR ALTERNATIVES TO TIER 1 *R*-VALUE REQUIREMENTS

| Climate zone | Exterior ceiling *U*-factor | | Exterior wall *U*-factor | Exterior floor *U*-factor |
|---|---|---|---|---|
| | Single-section | Multi-section | | |
| 1 | 0.061 | 0.057 | 0.094 | 0.049 |
| 2 | 0.061 | 0.057 | 0.094 | 0.056 |
| 3 | 0.061 | 0.057 | 0.068 | 0.049 |

TABLE 460.102–4—*U*-FACTOR ALTERNATIVES TO TIER 2 *R*-VALUE REQUIREMENTS

| Climate zone | Exterior ceiling *U*-factor | | Exterior wall *U*-factor | Exterior floor *U*-factor |
|---|---|---|---|---|
| | Single-section | Multi-section | | |
| 1 | 0.045 | 0.043 | 0.094 | 0.078 |
| 2 | 0.045 | 0.043 | 0.047 | 0.056 |
| 3 | 0.038 | 0.037 | 0.047 | 0.032 |

(c) *Performance requirements.* (1) The building thermal envelope must have a $U_o$ that is less than or equal to the applicable value specified in Tables 460.102–5 and 460.102–6 of this section.

TABLE 460.102–5—TIER 1 BUILDING THERMAL ENVELOPE PERFORMANCE REQUIREMENTS

| Climate zone | Single-section $U_o$ | Multi-section $U_o$ |
|---|---|---|
| 1 | 0.110 | 0.109 |
| 2 | 0.091 | 0.087 |
| 3 | 0.074 | 0.072 |

TABLE 460.102–6—TIER 2 BUILDING THERMAL ENVELOPE PERFORMANCE REQUIREMENTS

| Climate zone | Single-section $U_o$ | Multi-section $U_o$ |
|---|---|---|
| 1 | 0.086 | 0.082 |
| 2 | 0.062 | 0.063 |
| 3 | 0.053 | 0.052 |

(2) Area-weighted average vertical fenestration *U*-factor must not exceed 0.48 in climate zone 2 or 0.40 in climate zone 3. Adapted from section R402 of the 2021 IECC.

(3) Area-weighted average skylight *U*-factor must not exceed 0.75 in climate zone 2 and climate zone 3. Adapted from section R402 of the 2021 IECC.

(4) Windows, skylights and doors containing more than 50 percent glazing by area must satisfy the SHGC requirements established in paragraph (b)(1) of this section on the basis of an area-weighted average. Adapted from section R402 of the 2021 IECC.

(d) *Determination of compliance with paragraph (c) of this section.* (1) $U_o$ must be determined in accordance with Overall *U*-Values and Heating/Cooling Loads—Manufactured Homes (incorporated by reference; see § 460.3)

(2) [Reserved]

**§ 460.103 Installation of insulation.**

Insulating materials must be installed according to the insulation manufacturer's installation instructions and the requirements set forth in Table 460.103 of this section, which is adapted from section R402 of the 2021 IECC.

TABLE 460.103—INSTALLATION OF INSULATION

| Component | Installation requirements |
|---|---|
| General | Air-permeable insulation must not be used as a material to establish the air barrier. |
| Access hatches, panels, and doors | Access hatches, panels, and doors between conditioned space and unconditioned space must be insulated to a level equivalent to the insulation of the surrounding surface, must provide access to all equipment that prevents damaging or compressing the insulation, and must provide a wood-framed or equivalent baffle or retainer when loose fill insulation is installed within an exterior ceiling assembly to retain the insulation both on the access hatch, panel, or door and within the building thermal envelope. |
| Baffles | Baffles must be constructed using a solid material, maintain an opening equal or greater than the size of the vents, and extend over the top of the attic insulation. |
| Ceiling or attic | The insulation in any dropped ceiling or dropped soffit must be aligned with the air barrier. |
| Eave vents | Air-permeable insulations in vented attics within the building thermal envelope must be installed adjacent to eave vents. |
| Narrow cavities | Batts to be installed in narrow cavities must be cut to fit or narrow cavities must be filled with insulation that upon installation readily conforms to the available cavity space. |
| Rim joists | Rim joists must be insulated such that the insulation maintain permanent contact with the exterior rim board. |
| Shower or tub adjacent to exterior wall | Exterior walls adjacent to showers and tubs must be insulated. |
| Walls | Air permeable exterior building thermal envelope insulation for framed exterior walls must completely fill the cavity, including within stud bays caused by blocking lay flats or headers. |

**§ 460.104 Building thermal envelope air leakage.**

Manufactured homes must be sealed against air leakage at all joints, seams, and penetrations associated with the building thermal envelope in accordance with the component manufacturer's installation instructions and the requirements set forth in Table 460.104 of this section. Sealing methods between dissimilar materials must allow for differential expansion, contraction and mechanical vibration, and must establish a continuous air barrier upon installation of all opaque components of the building thermal envelope. All gaps and penetrations in the exterior ceiling, exterior floor, and exterior walls, including ducts, flue shafts, plumbing, piping, electrical wiring, utility penetrations, bathroom and kitchen exhaust fans, recessed lighting fixtures adjacent to unconditioned space, and light tubes adjacent to unconditioned space, must be sealed with caulk, foam, gasket or other suitable material. The air barrier installation criteria is adapted from section R402 of the 2021 IECC.

TABLE 460.104—AIR BARRIER INSTALLATION CRITERIA

| Component | Air barrier criteria |
|---|---|
| Ceiling or attic | The air barrier in any dropped ceiling or dropped soffit must be aligned with the insulation and any gaps in the air barrier must be sealed with caulk, foam, gasket, or other suitable material. Access hatches, panels, and doors, drop-down stairs, or knee wall doors to unconditioned attic spaces must be weather-stripped or equipped with a gasket to produce a continuous air barrier. |
| Duct system register boots | Duct system register boots that penetrate the building thermal envelope or the air barrier must be sealed to the subfloor, wall covering or ceiling penetrated by the boot, air barrier, or the interior finish materials with caulk, foam, gasket, or other suitable material. |

TABLE 460.104—AIR BARRIER INSTALLATION CRITERIA—Continued

| Component | Air barrier criteria |
|---|---|
| Electrical box or phone box on exterior walls | The air barrier must be installed behind electrical and communication boxes or the air barrier must be sealed around the box penetration with caulk, foam, gasket, or other suitable material. |
| Floors | The air barrier must be installed at any exposed edge of insulation. The bottom board may serve as the air barrier. |
| Mating line surfaces | Mating line surfaces must be equipped with a continuous and durable gasket. |
| Recessed lighting | Recessed light fixtures installed in the building thermal envelope must be sealed to the drywall with caulk, foam, gasket, or other suitable material. |
| Rim joists | The air barrier must enclose the rim joists. The junctions of the rim board to the sill plate and the rim board and the subfloor must be air sealed. |
| Shower or tub adjacent to exterior wall | The air barrier must separate showers and tubs from exterior walls. |
| Walls | The junction of the top plate and the exterior ceiling, and the junction of the bottom plate and the exterior floor, along exterior walls must be sealed with caulk, foam, gasket, or other suitable material. |
| Windows, skylights, and exterior doors | The rough openings around windows, exterior doors, and skylights must be sealed with caulk or foam. |

## Subpart C—HVAC, Service Hot Water, and Equipment Sizing

### § 460.201 Duct systems.

Each manufactured home equipped with a duct system, which may include air handlers and filter boxes, must be sealed to limit total air leakage to less than or equal to four (4) cubic feet per minute per 100 square feet of conditioned floor area. Building framing cavities must not be used as ducts or plenums when directly connected to mechanical systems. The duct total air leakage requirements are adapted from section R403 of the 2021 IECC.

### § 460.202 Thermostats and controls.

(a) At least one thermostat must be provided for each separate heating and cooling system installed by the manufacturer. The thermostat and controls requirements are adapted from section R403 of the 2021 IECC.

(b) Programmable thermostat. Any thermostat installed by the manufacturer that controls the heating or cooling system must—

(1) Be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day and different days of the week;

(2) Include the capability to set back or temporarily operate the system to maintain zone temperatures down to 55 °F (13 °C) or up to 85 °F (29 °C); and

(3) Initially be programmed with a heating temperature set point no higher than 70 °F (21 °C) and a cooling temperature set point no lower than 78 °F (26 °C).

(c) Heat pumps with supplementary electric-resistance heat must be provided with controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load.

### § 460.203 Service hot water.

(a) Service hot water systems installed by the manufacturer must be installed according to the service hot water manufacturer's installation instructions. Where service hot water systems are installed by the manufacturer, the manufacturer must ensure that any maintenance instructions received from the service hot water system manufacturer are provided with the manufactured home. The service hot water requirements are adapted from section R403 of the 2021 IECC.

(b) Any automatic and manual controls, temperature sensors, pumps associated with service hot water systems must provide access.

(c) Heated water circulation systems must—

(1) Be provided with a circulation pump;

(2) Ensure that the system return pipe is a dedicated return pipe or a cold water supply pipe;

(3) Not include any gravity or thermosyphon circulation systems;

(4) Ensure that controls for circulating heated water circulation pumps start the pump based on the identification of a demand for hot water within the occupancy; and

(5) Ensure that the controls automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water.

(d) All hot water pipes—

(1) Outside conditioned space must be insulated to a minimum *R*-value of *R*-3; and

(2) From a service hot water system to a distribution manifold must be insulated to a minimum *R*-value of *R*-3.

### § 460.204 Mechanical ventilation fan efficacy.

(a) Whole-house mechanical ventilation system fans must meet the minimum efficacy requirements set forth in Table 460.204 of this section, except as provided in paragraph (b) of this section. The mechanical ventilation fan efficacy requirements are adapted from section R403 of the 2021 IECC.

TABLE 460.204—MECHANICAL VENTILATION SYSTEM FAN EFFICACY

| Fan type description | Airflow rate minimum (cfm) | Minimum efficacy (cfm/watt) |
|---|---|---|
| Heat recovery ventilator or energy recovery ventilator | Any | 1.2 |
| In-line supply or exhaust fans | Any | 3.8 |
| Other exhaust fan | <90 | 2.8 |
| Other exhaust fan | ≥90 | 3.5 |

(b) Mechanical ventilation fans that are integral to heating, ventilating, and air conditioning equipment, including furnace fans as defined in § 430.2 of this title, are not subject to the efficiency requirements in paragraph (a) of this section.

**§ 460.205 Equipment sizing.**

Sizing of heating and cooling equipment installed by the manufacturer must be determined in accordance with ACCA Manual S (incorporated by reference; see § 460.3) based on building loads calculated in accordance with ACCA Manual J (incorporated by reference; see § 460.3). The equipment sizing criteria are adapted from section R403 of the 2021 IECC.

[FR Doc. 2021–17684 Filed 8–25–21; 8:45 am]

**BILLING CODE 6450–01–P**