DEPARTMENT OF ENERGY

10 CFR Part 460

[Docket No. EERE–2009–BT–BC–0021]

RIN 1904–AC11

Energy Conservation Standards for Manufactured Housing

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

ACTION: Notice of proposed rulemaking and public meeting.

SUMMARY: The U.S. Department of Energy (DOE) is publishing a proposed rule to implement the Energy Independence and Security Act of 2007, which directs DOE to establish energy conservation standards for manufactured housing. DOE proposes to establish energy conservation standards for manufactured housing based on the negotiated consensus recommendations of the manufactured housing working group (MH working group). The MH working group's recommendations were based on the 2015 edition of the International Energy Conservation Code (IECC), the impact of the IECC on the purchase price of manufactured housing, total lifecycle construction and operating costs, factory design and construction techniques unique to manufactured housing, and the current construction and safety standards set forth by U.S. Department of Housing and Urban Development.

DATES: DOE will accept comments, data, and information regarding this proposed rule before and after the public meeting, but no later than August 16, 2016 DOE will hold a public meeting on Wednesday, July 13, 2016 from 9:00 a.m. to 4:00 p.m. in Washington, DC.

ADDRESSES: The public meeting will be held at the U.S. Department of Energy, Forrestal Building, Room 1E–245, 1000 Independence Avenue SW., Washington, DC 20585–0121. To attend, please notify Ms. Brenda Edwards at (202) 586–2945. Please note that foreign nationals visiting DOE Headquarters are subject to advance security screening procedures. Any foreign national wishing to participate in the public meeting should advise DOE as soon as possible by contacting Ms. Brenda Edwards at (202) 586–2945 to initiate the necessary procedures.

Any comments submitted must identify the notice title, docket number EERE–2009–BT–BC–0021, and/or the regulatory identifier number (RIN) 1904–AC11. Comments may be submitted using any of the following methods:

1. *Federal eRulemaking Portal: www.regulations.gov*. Follow the instructions for submitting comments.

2. *Email: ManufacturedHousing 2009BC0021@ee.doe.gov*. Include docket number EE–2009–BT–BC–0021 and/or RIN 1904–AC11 in the subject line of the message.

3. *Mail:* Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program Mailstop EE–2J, 1000 Independence Avenue SW., Washington, DC 20585–0121.

4. *Hand Delivery/Courier:* Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, Suite 600, 950 L'Enfant Plaza SW., Washington, DC 20024. Telephone: (202) 586–2945.

Due to potential delays in DOE's receipt and processing of mail sent through the U.S. Postal Service, DOE encourages respondents to submit electronically to ensure timely receipt.

For detailed instructions on submitting comments and additional information on the rulemaking process, see section V of this document (''Public Participation'').

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

A link to the docket Web page can be found at: *http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx?ruleid=97*. This Web page contains a link to the docket for this notice on the *regulations.gov* site. The *regulations.gov* Web page also contains instructions on how to access all documents, including public comments, in the docket. See section V of the **SUPPLEMENTARY INFORMATION** for more information on how to submit comments for this rulemaking through *regulations.gov.*

For further information on how to submit or review public comments, participate in the public meeting, or view hard copies of the docket, contact Ms. Brenda Edwards, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, EE–2J, 1000 Independence Avenue SW., Washington, DC 20585–0121; (202) 586–2945; *Brenda.Edwards@ee.doe.gov*.

FOR FURTHER INFORMATION CONTACT: Mr. Joseph Hagerman, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program (EE–2J), 1000 Independence Avenue SW., Washington, DC, 20585; (202) 586–4549; *joseph.hagerman@ee.doe.gov*.

For information on legal issues presented in this document, contact: Ms. Kavita Vaidyanathan, U.S. Department of Energy, Forrestal Building, Office of the General Counsel (GC–33), 1000 Independence Avenue SW., Washington, DC, 20585; (202) 586–0669; *kavita.vaidyanathan@hq.doe.gov*.

DOE proposes to incorporate by reference into part 460 the following industry standards:

(1) Manual J—Residential Load Calculation (8th Edition).

(2) Manual S—Residential Equipment Selection (2nd Edition).

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, 703–575–4477, *http://www.acca.org/*.

(3) Overall U-Values and Heating/Cooling Loads—Manufactured Homes. Conner C.C., Taylor, Z.T., Pacific Northwest Laboratory, published February 1, 1992.

You may purchase a copy of Overall U-Values and Heating/Cooling Loads—Manufactured Homes from *http://www.huduser.org/portal/publications/manufhsg/uvalue.html* 800–245–2691.

For a further discussion of these standards, see section V.N of this document.

SUPPLEMENTARY INFORMATION:

I. Synopsis of the Proposed Rule

A. The Proposed Regulations

The Energy Independence and Security Act of 2007 (EISA, Pub. L. 110–140) directs the U.S. Department of Energy (DOE) to establish energy conservation standards for manufactured housing. 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 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. In accordance with this statutory directive, DOE is proposing energy conservation standards for manufactured housing. These energy conservation standards would be codified in a new part of the Code of Federal Regulations (CFR) under 10 CFR part 460 subparts A, B, and C.

Subpart A discusses generally the scope of the proposed rule and provides proposed definitions of key terms. The subpart also would provide manufacturers with a one-year lead time for compliance such that the standards would apply to all manufactured homes manufactured on or after one year following the publication of a final rule.

Subpart B would establish requirements related to climate zones and the building thermal envelope of manufactured homes. DOE proposes to base its energy conservation requirements on four climate zones, which generally follow state borders, with some exceptions. Regarding the building thermal envelope, DOE proposes two approaches to compliance. The first is a prescriptive approach that would establish specific requirements for component and fenestration thermal resistance (*R*-value), thermal transmittance (*U*-factor), and solar heat gain coefficient (SHGC). The second is a performance-based approach that would establish a maximum overall thermal transmittance (U_o) requirement for the building thermal envelope and additional *U*-factor and SHGC requirements. Subpart B also would include provisions for determining *U*-factor, *R*-value, SHGC, and U_o. Finally, subpart B would establish prescriptive requirements for insulation and sealing the building thermal envelope to limit air leakage.

Subpart C would establish requirements related to duct leakage; heating, ventilation, and air conditioning (HVAC); service hot water systems; mechanical ventilation fan efficacy; and heating and cooling equipment sizing.

B. Benefits and Costs to Purchasers of Manufactured Housing

As explained in greater detail in section IV of this document and in chapter 9 of the technical support document (TSD) accompanying this proposed rule, DOE estimates that benefits to manufactured homeowners in terms of lifecycle cost (LCC) savings and energy cost savings under the proposed rule would outweigh the potential increase in purchase price for manufactured homes. As presented in Table I.1, DOE estimates that the average purchase price of a manufactured home under the proposed rule would increase as much as $2,423 for a single-section and $3,745 for a multi-section manufactured home as a result of the increased construction costs associated with energy conservation improvements.

TABLE I.1—NATIONAL AVERAGE MANUFACTURED HOUSING PURCHASE PRICE (AND PERCENTAGE) INCREASES UNDER THE PROPOSED RULE

	Single-section		Multi-section	
	($)	(%)	($)	(%)
Climate Zone 1	2,422	5.3	3,748	4.5
Climate Zone 2	2,348	5.1	3,668	4.4
Climate Zone 3	2,041	4.5	2,655	3.2
Climate Zone 4	2,208	4.8	2,877	3.4
National Average	2,226	4.9	3,109	3.7

As explained in more detail in section IV.A of this document and in chapter 9 of the TSD, Table I.2 presents the estimated national average LCC savings and energy savings that a manufactured homeowner would experience under the proposed rule as compared to a manufactured home constructed in accordance with the minimum requirements of the existing HUD Code at 24 CFR part 3282. Table I.2 and Figure I.1 present the nationwide average simple payback period (purchase price increase divided by first year energy cost savings) under the proposed rule.

TABLE I.2—NATIONAL AVERAGE PER-HOME COST SAVINGS UNDER THE PROPOSED RULE

	Single-section	Multi-section
Lifecycle Cost Savings (30-Year Lifetime)	$3,211	$4,625.
Annual Energy Cost Savings in 2015 dollars	$345	$490.
Simple Payback	7.1 years	6.9 years.

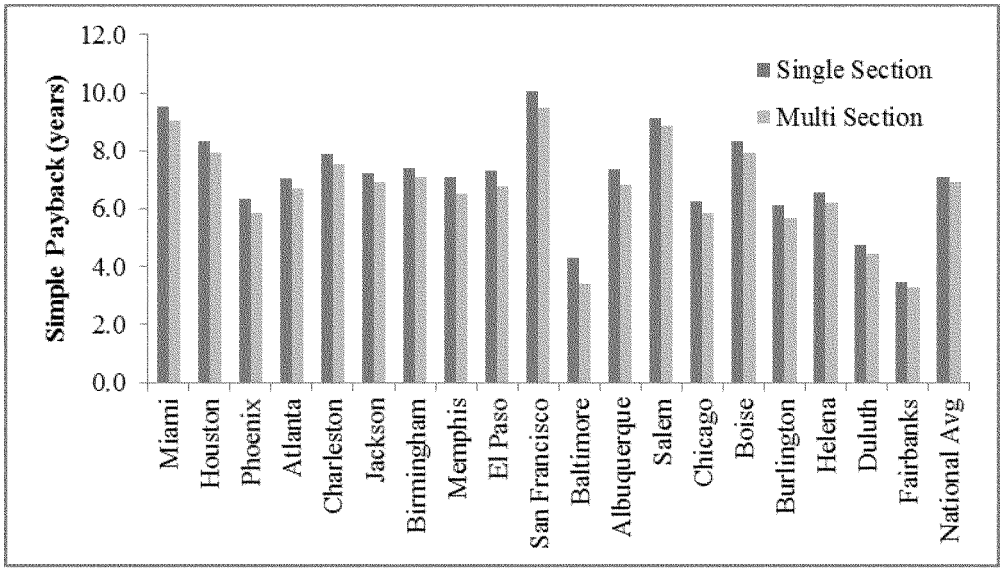


Figure I.1: Simple Payback Period of the Proposed Rule

C. Manufacturer Impact

As discussed in more detail in section IV.B of this document and chapter 12 of the TSD, the industry net present value (INPV) is the sum of the discounted cash flows to the industry from the announcement year (2016) through the end of the analysis period (2046). Using a real discount rate of 9.2 percent, DOE estimates the base case INPV for manufacturers to be $716.7 million. Under the proposed standards, DOE expects that the INPV will be reduced by 0.7 to 6.8 percent. Industry conversion costs are expected to total $1.6 million.

D. Nationwide Impacts

As described in more detail in section IV.C of this document and chapter 11 of the TSD, DOE's national impact analysis (NIA) projects a net benefit to the nation as a whole as a result of the proposed rule in terms of national energy savings (NES) and the net present value (NPV) of expected total manufactured homeowner costs and savings as compared with 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 equipment costs, and NPV of manufactured homeowner benefits for manufactured homes sold in a 30-year period from 2017 through 2046. The NIA builds off the LCC analysis discussed by the MH working group by aggregating results for all affected shipments over a 30-year period. All NES and percent 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.3 and Table I.4 illustrate the cumulative NES over the 30-year analysis period under the proposed rule 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 percent 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.3—CUMULATIVE NATIONAL ENERGY SAVINGS INCLUDING FULL-FUEL-CYCLE OF MANUFACTURED HOMES PURCHASED 2017–2046 WITH A 30-YEAR LIFETIME

	Single-section quadrillion British thermal units (BTUs) (quads)	Multi-section quadrillion BTUs (quads)
Climate Zone 1	0.179	0.294
Climate Zone 2	0.130	0.245
Climate Zone 3	0.272	0.474
Climate Zone 4	0.303	0.416

TABLE I.3—CUMULATIVE NATIONAL ENERGY SAVINGS INCLUDING FULL-FUEL-CYCLE OF MANUFACTURED HOMES PURCHASED 2017–2046 WITH A 30-YEAR LIFETIME—Continued

	Single-section quadrillion British thermal units (BTUs) (quads)	Multi-section quadrillion BTUs (quads)
Total	0.884	1.428

TABLE I.4—PERCENTAGE OF CUMULATIVE NATIONAL ENERGY SAVINGS INCLUDING FULL-FUEL-CYCLE OF MANUFACTURED HOMES PURCHASED 2017–2046 WITH A 30-YEAR LIFETIME

	Single-section (%)	Multi-section (%)
Climate Zone 1	25.3	29.9
Climate Zone 2	25.4	30.6
Climate Zone 3	26.0	28.1
Climate Zone 4	25.4	26.6
Total	25.6	28.3

Table I.5 and I.6 illustrate the NPV of customer benefits over the 30-year analysis period under the proposed rule for a discount rate of 7 percent and 3 percent, respectively. The NPV of customer benefits differ among the four climate zones because of differing initial costs and corresponding operating cost savings, as well as differing shipment projections in each climate zone. Under the proposed rule, all climate zones have a positive NPV for both discount rates.

TABLE I.5—NET PRESENT VALUE OF CUSTOMER BENEFITS FOR MANUFACTURED HOMES PURCHASED 2017–2046 WITH A 30-YEAR LIFETIME AT A 7% DISCOUNT RATE

	Single-section (billion 2015$)	Multi-section (billion 2015$)
Climate Zone 1	0.19	0.34
Climate Zone 2	0.16	0.35
Climate Zone 3	0.39	0.74
Climate Zone 4	0.52	0.74
Total	1.26	2.18

TABLE I.6—NET PRESENT VALUE OF CUSTOMER BENEFITS FOR MANUFACTURED HOMES PURCHASED 2017–2046 WITH A 30-YEAR LIFETIME AT A 3% DISCOUNT RATE

	Single-section (billion 2015$)	Multi-section (billion 2015$)
Climate Zone 1	0.66	1.16
Climate Zone 2	0.54	1.10
Climate Zone 3	1.22	2.26
Climate Zone 4	1.60	2.24
Total	4.03	6.75

E. Nationwide Environmental Benefits

As discussed in section IV.D of this document and in the NIA included in chapter 11 of the TSD accompanying this proposed rule, DOE's analyses indicate that the proposed rule would reduce overall demand for energy in manufactured homes. The proposed rule also would produce environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases associated with electricity production. DOE estimates that 18.1 million metric tons of carbon dioxide emissions would be avoided through the end of 2030 as a result of the proposed rule.

Emissions avoided under the proposed rule are related to the energy savings that would be achieved within manufactured homes. DOE estimates that, under the proposed rule, 2.3 quadrillion Btu (quads) of FFC energy would be saved relative to manufactured homes constructed under the minimum requirements of the HUD Code over a 30-year analysis period. 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.7 lists the emissions reductions under the proposed rule for both single-section and multi-section manufactured homes.

TABLE I.7—EMISSIONS REDUCTIONS ASSOCIATED WITH ELECTRICITY PRODUCTION FOR MANUFACTURED HOMES PURCHASED 2017–2046 WITH A 30-YEAR LIFETIME

Pollutant	Single-section	Multi-section
Site Emissions Reductions		
CO_2 (million metric tons)	56.5	91.1
Hg (metric tons)	0.0904	0.146
NO_X (thousand metric tons)	223	356
SO_2 (thousand metric tons)	27.6	44.4
CH_4 (thousand metric tons)	3.78	6.09
N_2O (thousand metric tons)	0.632	1.02
Upstream Emissions Reductions		
CO_2 (million metric tons)	4.01	6.45
Hg (metric tons)	0.000944	0.00153
NO_X (thousand metric tons)	51.8	83.2
SO_2 (thousand metric tons)	0.615	0.991
CH_4 (thousand metric tons)	239	385
N_2O (thousand metric tons)	0.0294	0.0474
Total Emissions Reductions		
CO_2 (million metric tons)	60.5	97.6
Hg (metric tons)	0.0913	0.148
NO_X (thousand metric tons)	275	439
SO_2 (thousand metric tons)	28.2	45.4
CH_4 (thousand metric tons)	243	391
N_2O (thousand metric tons)	0.661	1.07

Additionally, DOE has considered the estimated monetary benefits likely to result from the reduced emissions of CO_2 and NO_X that would be expected to result from the proposed rule. DOE calculated the monetary values for each of these emissions reductions using the social cost of carbon (SCC) model, which estimates the monetized damages associated with an incremental increase in carbon emissions within a given year. The SCC is intended to account for, but is not limited to, changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services.

Table I.8 provides the NPV of monetized emissions benefits from CO_2 and NO_X under the proposed rule. DOE estimates that the monetized benefits from emissions reductions associated with the proposed rule would be $5,541.5 million ($4,731.4 million in CO_2 emissions reductions plus $810.1 million in NO_X emissions reductions) over a 30-year analysis period at the 3 percent discount rate and the CO_2 cost associated with the average SCC case.

TABLE I.8—NET PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS UNDER THE PROPOSED RULE

Monetary benefits	Discount rate (%)	Net present value (million 2015$)	
		Single-section	Multi-section
CO_2, Average SCC Case *	5	368.2	593.7
CO_2, Average SCC Case *	3	1,810.9	2,920.5
CO_2, Average SCC Case *	2.5	2,925.0	4,717.3
CO_2, 95th Percentile SCC Case *	3	5,581.5	9,001.5
NO_X Reduction at $2,755/metric ton *	3	311.5	498.6
	7	119.8	191.9

* The CO_2 values represent global monetized values (in 2015$) of the social cost of CO_2 emissions reductions for manufactured homes shipped from 2017–2046 with a 30-year lifetime under several different scenarios of the SCC model. The ''average SCC case'' refers to average predicted monetary savings as predicted by the SCC model. The ''95th percentile case'' refers to values calculated using the 95th percentile impacts of the SCC model, which accounts for greater than expected environmental damages. The value for NO_X (in 2015$) is the average of the low and high values used in DOE's analysis.

F. Total Benefits and Costs

As explained in greater detail in section IV of this document and chapter 15 of the TSD, Table I.9 presents the total benefits and costs to manufactured homeowners associated with the proposed rule, expressed in terms of annualized values.[1]

TABLE I.9—TOTAL ANNUALIZED BENEFITS AND COSTS TO MANUFACTURED HOMEOWNERS UNDER THE PROPOSED RULE

	Discount rate (%)	Monetized (million 2015$/year)		
		Primary estimate **	Low estimate **	High estimate **
Benefits *				
Operating (Energy) Cost Savings	7	516	400	688.
	3	843	617	1,191.
CO_2, Average SCC Case ***	5	63	46	85.
CO_2, Average SCC Case ***	3	241	176	331.
CO_2, Average SCC Case ***	2.5	365	266	503.
CO_2, 95th Percentile SCC Case ***	3	744	543	1,022.
NO_X Reduction at $2,755/metric ton ***	7	25	20	32.
	3	41	31	56.
Total (Operating Cost Savings, CO_2 Reduction and NO_X Reduction).	7 plus CO_2 range	604 to 1,285	466 to 962	805 to 1,742.
	7	783	596	1,052.
	3	1,126	824	1,578.
	3 plus CO_2 range	947 to 1,628	694 to 1,191	1,332 to 2,269.
Costs *				
Incremental Purchase Price Increase	7	220	165	285.
	3	277	192	378.
Net Benefits/Costs *				
Total (Operating Cost Savings, CO_2 Reduction and NO_X Reduction, Minus Incremental Cost Increase to Homes).	7 plus CO_2 range	384 to 1,065	301 to 797	520 to 1,457.
	7	563	431	767.
	3	849	632	1,200.
	3 plus CO_2 range	670 to 1,351	502 to 999	954 to 1,891.

* The benefits and costs are calculated for homes shipped in 2017–2046.

** The Primary, Low, and High Estimates utilize forecasts of energy prices from the 2015 *AEO* Reference case, Low Economic Growth case, and High Economic Growth case, respectively.

*** The CO_2 values represent global monetized values (in 2015$) of the social cost of CO_2 emissions reductions over the analysis period under several different scenarios of the SCC model. The ''average SCC case'' refers to average predicted monetary savings as predicted by the SCC model. The ''95th percentile case'' refers to values calculated using the 95th percentile impacts of the SCC model, which accounts for greater than expected environmental damages. The value for NO_X (in 2015$) is the average of the low and high values used in DOE's analysis.

II. Introduction

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 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.

Section 413 of EISA also provides that DOE may:

Consider the design and factory construction techniques of manufactured housing;

- Base the climate zones under the proposed rule on the climate zones established by HUD in 24 CFR part 3280 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 as proposed.

DOE is directed to update its standards not later than one year after any revision to the IECC. Finally, section 413 of EISA authorizes DOE to impose civil penalties on any manufacturer that violates a provision of part 460.

B. Background

1. Current Regulation of Manufactured Housing

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.

[1] As stated in this preamble, 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 2015, 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. For the latter, DOE used a range of discount rates, as shown in Table I.8. From the present value, DOE then calculated the fixed annual payment over a 30-year period, starting in 2017 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.

HUD has regulated the manufactured housing industry since 1976, when it first promulgated the HUD Code. The purpose of the HUD Code has been to reduce personal injuries, deaths, property damage, and insurance costs, and to improve the quality, durability, safety, and affordability of manufactured homes. *See* 42 U.S.C. 5401(b).

The HUD Code includes requirements related to the energy conservation of 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 climate zones. *See* 24 CFR 3280.507(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. *See id.* 3280.508(d). Moreover, Subpart F of the HUD Code establishes requirements to reduce air leakage through the building thermal envelope. *See id.* 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. *See id.* 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 SHGC, mechanical system piping insulation, or installation of insulation.

It is important to note that 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. In development of the proposed regulations, DOE seeks to make every effort to ensure that compliance with this proposed requirements would not impinge a manufacturer from complying with the requirements set forth in the HUD Code.

Additionally, DOE is seeking to avoid any potential redundancy between the proposed requirements and the HUD Code. Accordingly, section III.D of this document charts the relationship between the energy conservation requirements in the HUD Code and the proposed DOE requirements. Given the level of detail required in analyzing all aspects of energy conservation contained in both the proposed rule and the HUD Code, DOE requests comment on any potential inconsistencies that would result from promulgation of the proposed regulations.

2. The International Energy Conservation Code

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, 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. *See* 42 U.S.C. 17071. The IECC is a nationally recognized model code, developed under the auspices of, and published by, the International Code Council (ICC), which many state and local governments have adopted in establishing minimum design and construction requirements for the energy efficiency of residential and commercial buildings, including site-built residential and modular homes. The IECC is developed through a consensus process that seeks input from industry 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, and it has been updated continuously since that time. The 2015 edition of the IECC (the 2015 IECC) was published in May 2014.

Chapter 4 of the 2015 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, circulating hot water system piping, and mechanical ventilation. Chapter 4 of the 2015 IECC was developed for residential buildings generally and are not specific to manufactured housing. To the extent that the HUD Code regulates similar aspects of energy conservation as the 2015 IECC, the 2015 IECC is generally considered to be more stringent than the corresponding requirement in the HUD Code given that many areas of the HUD Code are not updated as frequently as the IECC.

3. Development of the Proposed Rule

Manufactured housing accounts for approximately six percent of all homes in the United States.[2] 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. Nevertheless, the operational costs to the homeowner may not be reflected in the purchase price of the home. Manufactured housing home owners often have higher utility bills than comparably built site-built and modular homes in part due to different criteria for energy conservation and variability among building codes and industry practice.

Establishing robust energy conservation requirements for manufactured homes would result in the dual benefit of substantially reducing manufactured home energy use and easing the financial burden on owners of manufactured homes in meeting their monthly utility expenses. Improved energy conservation standards are expected to provide nationwide benefits of reducing utility energy production levels that would in turn reduce greenhouse gas emissions and other air pollutants.

On February 22, 2010, 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. *See* 75 FR 7556. The ANOPR identified thirteen specific issue areas on which DOE sought additional information. DOE received a total of twelve written comments in response to the ANOPR, all of which are available for public viewing at the regulations.gov Web page.[3]

DOE also has consulted with HUD in developing the proposed 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

[2] *See* U.S. Census Bureau, *American Housing Survey 2013—National Summary Tables.*

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

meetings, where DOE gathered information from MHCC members. DOE also initiated further discussions with members of the manufactured housing industry following the issuance of the ANOPR, including the Manufactured Housing Institute and several of its member manufacturers, the State of California Department of Housing and Community Development, the State of 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. A summary of each meeting is available at the regulations.gov Web page.

The following section provides a summary of comments DOE received in response to the ANOPR. Generally, the comments can be grouped into five main areas: Climate zones; the basis for the proposed standards; specific building thermal envelope requirements; enforcement of DOE's proposed energy conservation standards; and the need for, and scope of, the proposed rule.

Regarding the issue of climate zones, DOE received comments recommending that DOE define climate zones at the county level, possibly based on the climate zones established in the IECC or on a subset of those climate zones to align with the requirements for site-built homes. Generally, these commenters stated that the IECC climate zones are recognized and understood by the manufacturing and regulatory sectors. Conversely, DOE received other comments indicating a preference for retaining the three climate zones established in the HUD Code. DOE also received comments suggesting that DOE consider more refined climate zones in the southern United States, noting the abundance of manufactured homes sold in that region of the country. As discussed in section III.B.2.a) of the document, DOE proposes to base its energy conservation standards on four climate zones. DOE requests comment on the proposed use of four climate zones relative to adopting the three HUD climate zones and whether there are any potential impacts on manufacturing costs, compliance costs, or other impacts, in particular in Arizona, Texas, Louisiana, Mississippi, Alabama, and Georgia, where the agency has proposed two different energy efficiency standards within the same state.

DOE received numerous comments suggesting that DOE base its proposed energy conservation standards on the IECC rather than on the energy conservation standards established by HUD. Specifically, one commenter stated that IECC training and related support services would be available if DOE based its energy conservation standards on the IECC that would be absent if DOE used a different basis for the proposed energy conservation standards. Another commenter suggested that the proposed energy conservation standards should be at a minimum as efficient as the requirements contained in the most recent edition of the IECC or better where lifecycle cost effective. One commenter stated that the IECC was not intended to apply to manufactured housing and that DOE should consider altering IECC standards to be compatible with manufactured housing building processes. However, another commenter stated that there are no intrinsic differences between site-built and factory-built construction techniques that would limit DOE from proposing energy conservation standards to the level set forth in the most recent edition of the IECC and beyond.

Other commenters discussed specific energy conservation requirements that should be included in the proposed rule, including requiring high-efficiency furnaces, boilers, and heat pump heating in colder climate zones, high-efficiency air conditioners in warmer climate zones, ENERGY STAR appliances, and improved lighting systems, where cost-effective. Commenters also requested that DOE consider requiring *R*-5 windows, passive solar design, and establishing provisions to address barriers to future technology. Conversely, one commenter stated that the HUD Code balances requirements related to both air leakage and condensation. Other commenters requested that DOE consider the National Fire Protection Association (NFPA) Standard on Manufactured Housing in developing its proposed standards and that DOE also consider certain applicable requirements contained in the International Residential Code. Another commenter suggested that DOE develop standards that would allow above-code programs, such as ENERGY STAR, to build upon the requirements set forth by DOE. DOE also received several comments that manufactured homes should be as energy efficient as site-built and modular homes while asserting that DOE's energy conservation standards be no more stringent than the requirements for site-built housing. However, it also was suggested that DOE consider establishing one or more performance tiers above the minimum DOE energy conservation standards, with associated incentives for manufacturers, to drive the market for high performance manufactured housing.

As discussed further in section III.A of this document, DOE proposes to base its energy conservation standards on the 2015 IECC while accounting for the potential effects on purchase price, total lifecycle construction and operating costs, and design and factory construction techniques unique to manufactured homes.

With respect to the potential effects of the proposed rule on purchase price and total lifecycle construction and operating costs, DOE received comments providing specific information that assisted DOE in its preliminary economic analyses for developing the proposed requirements. Regarding the issue of home financing, commenters recommended that DOE's economic analysis on financing assume terms of loans similar to those for new site-built homes, accompanied by a three percent discount rate. Other commenters suggested that DOE's economic analyses assume terms of loans that reflect a mix of real estate and personal property loans that are reflective of the market share of each type of loan and that account for historical trends in loans for manufactured housing. Another commenter suggested that DOE account for conventional financing rates of five to seven percent and assume full resale recovery, as recognized by the National Automobile Dealers Association in appraisal value for ENERGY STAR-labeled manufactured homes.

It was suggested that DOE account for volume procurement purchasing prices, collect cost data from manufacturers and major suppliers provided in manufactured homes by state and region, and use standard industry mark-ups in conducting its economic analyses. Commenters also stated that any increase in the purchase price of a manufactured home could exacerbate the lack of affordable housing. Commenters further stated that although manufacturers offer manufactured homes that exceed the energy conservation requirements contained in the HUD Code, financing the cost of those additional energy features often is an obstacle to such homes being purchased. Accordingly, it was suggested that DOE apply the same analytical framework that DOE uses for developing energy efficiency standards for appliances in developing the proposed energy conservation standards. Specifically, one commenter suggested that DOE conduct parametric and statistical modeling analyses accounting for various factors, including

single-wide versus multi-wide manufactured homes, differences among fuel types, duct locations, eliminating various ''trade-offs,'' and evaluating solar thermal and photovoltaic systems in establishing the proposed standards.

With respect to design and construction techniques unique to manufactured homes, DOE received several comments highlighting that the manufactured housing industry has been producing manufactured homes that exceed the energy conservation requirements contained in the HUD Code. One commenter stated that since 1989, over 100,000 manufactured homes had been built in the Pacific Northwest region of the United States that have an energy efficiency level that complies with the most recent version of the IECC. Another commenter provided specific examples of manufactured homes that exceeded the energy conservation requirements contained in the HUD Code. Indeed, DOE received comments stating that 90 percent of manufactured housing builders had adopted the U.S. Environmental Protection Agency (EPA) ENERGY STAR program for manufactured housing. Another commenter suggested that DOE utilize research results and information from the DOE Building America Program and the Partnership for Advancing Technology in Housing program at HUD in developing the proposed energy conservation standards and in determining the costs and benefits of more stringent standards. It was suggested that DOE also evaluate products such as foam wall sheathing, innovative roof systems, and solar thermal and photovoltaic systems in developing the proposed energy conservation standards, and to obtain information from HVAC equipment manufacturers on available equipment efficiencies specific to manufactured homes.

With respect to design and construction techniques unique to manufactured homes, one commenter suggested that DOE adopt the energy efficiency specifications contained in the IECC unless something unique about the production of a manufactured home necessitated a different standard. Another commenter stated that DOE should coordinate with HUD on the development of the proposed rule and to make recommendations to HUD on non-energy-related issues for HUD consideration in updating the HUD Code. Specifically, it was suggested that DOE recognize exterior height and width limitations of manufactured homes in its proposed standards. DOE has attempted to address these comments by proposing thermal performance requirements that are similar to the HUD Code, while proposing other specific energy conservation requirements that are based on the requirements set forth in the 2015 edition of the IECC. DOE also has attempted to address unique aspects of manufactured homes in the proposed rule that would not be addressed by the proposed requirements for overall thermal performance.

Regarding specific building thermal envelope requirements, DOE received a number of comments requesting that DOE retain the thermal envelope performance approach set forth in the HUD Code, rather than component prescriptive measures, in order to facilitate application and use of innovative technology and materials. Another commenter suggested that DOE consider HUD's *U*-factor calculation manual in developing the proposed standards. As discussed in section III.B.2.b) of this document, DOE proposes to establish thermal envelope requirements as a function of the overall thermal transmittance of the building thermal envelope of a manufactured home for consistency with the approach set forth in the HUD Code. DOE also proposes prescriptive requirements as an alternative to the U_o requirement.

Regarding compliance with, and enforcement of, DOE's proposed energy conservation standards, DOE received a range of comments. First, DOE received comments suggesting that DOE rely on HUD's existing enforcement system rather than develop a separate DOE system of enforcement. Specifically, one commenter suggested that DOE consider using the existing HUD-approved third-party primary inspection agencies to ensure compliance with both HUD and DOE requirements for manufactured housing in order to avoid an increase in manufacturer fees and the creation of a duplicative system of compliance certification. Another commenter suggested that the HUD label be modified to reflect compliance with both the HUD and DOE requirements. Secondly, DOE received a comment that DOE develop a separate compliance certification system that would be independent of the existing HUD certification system. In this regard, it was suggested that DOE conduct in-plant and onsite inspections and audits using the DOE Building America Program and ENERGY STAR quality assurance protocols. It also was suggested that DOE's certification system ''complement'' the existing HUD system and that prospective DOE third-party certifiers receive adequate training to ensure that inspections would be conducted properly. Another commenter suggested that DOE rely on the EPA ENERGY STAR verification and labeling program to ensure compliance with the DOE energy conservation standards. One commenter suggested that DOE check the quality of construction while asserting that HUD should enforce violations of the DOE energy conservation standards. Furthermore, a commenter suggested that all manufactured homes be labeled using the DOE EnergySmart Home scale tool to demonstrate compliance with the proposed energy conservation standards.

Finally, DOE received comments questioning the need for the development of energy conservation standards, noting the state of the housing market and the time and cost associated with the process to develop such requirements. Conversely, DOE received other comments indicating that more stringent energy conservation requirements are ''urgently needed'' to prevent lost opportunities for energy and operating cost savings that are not currently being captured. DOE also was asked to consider adopting various energy efficiency improvements contained in the 2010 version of NFPA Standard 501. DOE received further comments indicating that the manufactured housing industry is in the unique position to meet national energy conservation goals while preserving home affordability. One commenter stated that increases in the purchase price of manufactured homes due to energy conservation improvements could raise issues of affordability without government subsidies or incentives. Another commenter similarly stated that raising energy conservation standards too quickly could impact manufacturers' ability to modify their in-plant production and site-installation processes and procedures. Other commenters requested that DOE delay the effective date of any energy conservation requirements due to current economic conditions in order to give manufacturers sufficient time to meet the new energy conservation standards. Finally, commenters urged DOE to consult and collaborate with HUD, EPA, and the manufactured housing industry in development of the proposed rule. DOE notes that it is required by statute to set forth energy conservation standards for manufactured homes, and DOE carefully has considered comments regarding the scope of the proposed rule in developing the energy conservation requirements proposed herein.

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 conservation standards for manufactured housing. (78 FR 37995) 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. 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. Moreover, commenters noted that a home that is equipped with proper mechanical ventilation, such as the mechanical ventilation level required by the HUD Code, is adequate to ensure indoor air quality. DOE is preparing the draft EA in parallel with this rulemaking, and it will be posted to the DOE Web site separately. This draft EA will discuss the relationship among indoor air quality, air leakage, and occupant health.

Comments on financing focused on the affordability of manufactured housing and the potential impacts of the proposed rule on the ability of purchasers of manufactured homes to qualify for financing. Commenters noted that increased costs associated with more energy efficient homes could have a negative impact on affordability in an industry in which the majority of home purchasers are low-income individuals and families. DOE has designed the proposed standards to achieve greater energy conservation in manufactured housing while accounting for the costs and benefits of the proposed standards on manufactured homeowners. In this regard, DOE has analyzed the lifecycle costs to low-income purchasers of manufactured homes (*see* chapter 9 of the TSD) and potential changes in manufactured home shipments in response to changes in purchase price (*see* chapter 10 of the TSD).

Commenters generally agreed that DOE should integrate a program of compliance and enforcement into the existing structure utilized by HUD. Commenters also noted, however, that DOE should maintain a role in overseeing enforcement of its standards. Although DOE is not considering compliance and enforcement in this proposed rule, DOE will consider these comments in a future rulemaking if appropriate.

DOE received other comments and data, including information on the average term of a manufactured housing loan. Another commenter stated that DOE should establish requirements that achieve the greatest possible energy conservation in manufactured housing, as the benefits of potential energy savings would outweigh potential increased purchase prices. Another commenter suggested that DOE develop standards that match the IECC as closely as possible. Finally, a commenter suggested that DOE abandon its rulemaking effort and begin the process anew while a set of joint commenters urged DOE to expedite publishing of a proposed rule. DOE has considered these comments in its analysis and the development of this proposed rule.

After reviewing the comments received in response both to the ANOPR and to 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 MH working group to discuss and, if possible, reach consensus on a proposed rule. *See* 79 FR 33873. On July 16, 2014, the MH working group was established under ASRAC in accordance with the Federal Advisory Committee Act and the Negotiated Rulemaking Act. *See* 79 FR 41456; 5 U.S.C. 561–70, 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 development of 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. 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. *See* 79 FR 48097; 79 FR 59154.

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. *See* 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 (the 2015 RFI) requesting information that would aid in its determination of proposed SHGC requirements for certain climate zones. (80 FR 7550) One commenter indicated that DOE's negotiated rulemaking process was analytically flawed and made many procedural errors in carrying out the rulemaking process, including the operation of the MH working group and the interpretation of the underlying statutory directive on accounting for cost-effectiveness. This commenter also provided alternative cost data for use in the cost-benefit analysis. DOE has included a more detailed discussion of the comments received in response to the request for information in section III.B of this document.

Following preparation and submission of the term sheet by the MH working group, DOE engaged in further consultation 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 the MHCC members, designed to gather information on the development of the proposed standards.

DOE has considered all information ascertained from HUD, state agencies, the manufactured housing industry, and the public in developing the proposed rule. In an attempt to understand how certain requirements included in DOE's proposed rule would impact other aspects of the design and construction of manufactured homes, DOE also has carefully reviewed the HUD Code to ensure that the proposed rule would avoid unintended conflicts with HUD requirements both related and unrelated to energy conservation.

The MH working group was established to negotiate energy conservation standards for manufactured housing and did not address options for systems of compliance and enforcement. DOE thus has not included proposed compliance and enforcement provisions in this document. DOE maintains its authority to address these issues in a future rulemaking.

DOE also has not included proposed provisions related to waivers or exception relief that would be available to manufacturers in achieving compliance with this Part. Regarding waivers, DOE is interested in receiving information on whether a process is warranted by which a manufacturer could petition DOE for relief from an individual requirement. DOE also seeks public input on whether to establish proposed provisions for exception relief, which would be warranted in instances in which compliance with the proposed regulations would result in serious hardship, gross inequity, or unfair distribution of burdens on the part of a

manufacturer. DOE may consider including proposed provisions in this regard in a future rulemaking.

III. Discussion

A. The Basis for the Proposed Standards

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.'' *See* 42 U.S.C. 17071(b). Given that the 2015 edition of the IECC (the 2015 IECC) constitutes ''the most recent version of the IECC,'' the MH working group based its recommendations on the specifications included in the 2015 IECC that are appropriate for manufactured homes, which DOE has considered in developing the proposed rule.

As noted above, the 2015 IECC applies generally to residential buildings, including site-built and modular housing, and is not specific to the manufactured housing industry. Consistent with the recommendations of the MH working group, DOE proposes standards that are based on certain specifications included in the 2015 IECC and that account for the unique aspects of manufactured housing. DOE carefully considered the following aspects of manufactured housing design and construction in developing the proposed 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.

Based on these considerations, and consistent with the recommendations of the MH working group, DOE is proposing certain requirements that differ from similar provisions contained in the 2015 IECC. These include presenting the building thermal envelope requirements in terms of U_o of the entire building thermal envelope, accounting for space limitations in ceiling assemblies when establishing insulation requirements and other revisions to ensure the text is applicable to manufactured housing.

Additionally, the MH working group recommended, and DOE considered, in developing this proposed rule the potential effects on purchase price and total lifecycle construction and operating costs, design and factory construction techniques unique to manufactured homes, and the impacts of reliance on the climate zones established by HUD and as set forth in the 2015 IECC. A detailed discussion of each of these issues is contained in chapter 8 of the TSD and sections III.B and III.C of this document.

The following section discusses in detail the proposed energy conservation standards as set forth in the proposed rule. Subpart A as proposed contemplates the scope of the proposed standards, proposed definitions of key terms, and other commercial standards that would be incorporated by reference into this part. The subpart also proposes a compliance date of one year following the publication of the final rule.

Proposed subpart B would include energy conservation requirements associated with the building thermal envelope of a manufactured home according to the climate zone in which the home is located. DOE proposes to base its building thermal envelope energy conservation standards on four climate zones, which generally follow state borders with some exceptions. DOE proposes two options to ensure an appropriate level of thermal transmittance through the building thermal envelope. The first approach contemplates prescriptive requirements for components of the building thermal envelope. The second is a performance-based approach under which a manufactured home would be required to achieve a maximum U_o in addition to fenestration *U*-factor and SHGC requirements. Subpart B also would establish prescriptive requirements for insulation and sealing the building thermal envelope to limit air leakage.

Subpart C would include requirements related to duct leakage; HVAC thermostats and controls; service water heating; mechanical ventilation fan efficacy; and equipment sizing.

As noted in this preamble, EISA requires DOE to update its energy conservation standards for manufactured housing not later than one year after any revision to the IECC. Pursuant to this statutory direction, DOE intends to update its energy conservation standards for manufactured housing, if promulgated, within one year of the publication of any revision to the 2015 IECC. This proposed rule invites comments on all DOE proposals and issues presented herein, and requests comments, data, and other information that would assist DOE in developing a final rule.

B. Proposed Energy Conservation Requirements

1. Subpart A: General

(a) § 460.1 Scope

Pursuant to section 413 of EISA, Congress directed DOE to establish standards for energy conservation in manufactured housing. Section 460.1 would restate the statutory requirement and introduce the scope of the proposed requirements. Section 460.1 also would require manufactured homes that are manufactured on or after one year following publication of the final rule to comply with the requirements established in part 460.

DOE proposes a one-year period following publication of a final rule to allow manufacturers to transition their designs, materials, and factory operations and processes to comply with the finalized DOE energy conservation standards and regulations. A one-year notice period is common industry practice for amendments to the IECC and other changes to building codes; however, DOE seeks input on whether these standards are analogous to IECC or whether they would impose a different level of manufacturer research and effort to comply. In addition, DOE seeks comment on whether additional lead time is necessary to harmonize compliance and enforcement with HUD's manufactured housing program, redesign manufactured housing to meet the standards, and test and certify the new designs. The agency also requests comment on whether there are any particular timing considerations that the agency should consider due to manufacturers choosing to comply with either the prescriptive or thermal envelope compliance paths. DOE requests comment on the scope and effective date of the proposed rule and whether the proposed effective date would provide manufacturers sufficient lead time to prepare to comply with the standards.

(b) § 460.2 Definitions

Section 460.2 would define key terms used throughout the proposed regulations, many of which were derived from either the 2015 IECC or the HUD Code, with modifications where further clarification was needed in the context of manufactured housing. Proposed definitions based on terms included in the 2015 IECC were developed in accordance with recommendations from the MH working group. *See* Term Sheet at 1. DOE has included a discussion of each of the

proposed definitions in the following paragraphs.

(a) Accessible. DOE proposes to adopt the definition of the term ''accessible'' from the 2015 IECC while clarifying that the definition would allow access to certain labels or control interfaces that require close approach upon inspection or repair.

(b) Air barrier. The term ''air barrier'' also would be based on the definition of the same term in the 2015 IECC while clarifying that an air barrier could consist of a single material or combination of materials. DOE intends for the definition of this term to include the materials involved in limiting air leakage to meet air sealing requirements and requests comment on whether further clarification is needed on the meaning in this regard.

(c) Automatic. DOE proposes to adopt the definition of the term ''automatic'' from the 2015 IECC. The terms ''automatic'' and ''manual'' would differentiate between controls that are operated by impersonal (automatic) and personal (manual) influences.

(d) Building thermal envelope. DOE has derived the proposed definition of ''building thermal envelope'' from the definition of the same term in the 2015 IECC, with revisions that account for the manner in which manufactured homes are designed and constructed. The proposed definition does not include basement walls, for example, given the unique construction of a manufactured home relative to a site-built home.

(e) Ceiling. DOE proposes to define the term ''ceiling,'' which is not defined in the 2015 IECC or the HUD Code, to ensure specificity with the proposed prescriptive standards of part 460.

(f) Circulating hot water system. DOE would define the term ''circulating hot water system'' to be consistent with the 2015 IECC to describe water distribution systems in a manufactured home that uses a pump to circulate water between water-heating equipment and fixtures.

(g) Climate zone. DOE proposes to define the term ''climate zone'' in accordance with the term as defined in the 2015 IECC, with revisions as applicable to the specific geographic regions set forth in the proposed rule. The proposed rule establishes different energy conservation standards for manufactured homes located in different climate zones.

(h) Conditioned space. DOE would adopt the definition of the term ''conditioned space'' from the 2015 IECC to describe areas, rooms, or spaces that are enclosed within the building envelope.

(i) Continuous air barrier. DOE proposes to adopt the definition of the term ''continuous air barrier'' from the 2015 IECC to encompass the material or combination of materials that limit air leakage through the building thermal envelope.

(j) Door. DOE would define the term ''door,'' which is not defined in the 2015 IECC or the HUD Code, to ensure specificity with the proposed prescriptive standards of part 460.

(k) Dropped ceiling. DOE proposes to define the term ''dropped ceiling,'' which is not defined in the 2015 IECC or the HUD Code, to ensure specificity with the proposed standards under §§ 460.103(a) and 460.104.

(l) Dropped soffit. DOE would define the term ''dropped soffit,'' which also is not defined in the 2015 IECC or the HUD Code, to ensure specificity with the proposed prescriptive standards under §§ 460.104(a) and 460.104.

(m) Duct. DOE proposes to adopt the definition of the term ''duct'' from the 2015 IECC to include tubes or conduits, except air passages within a self-contained system, used for conveying air to or from heating, cooling, or venting equipment.

(n) Duct system. DOE proposes to define the term ''duct system'' as derived from the meaning of the term under the 2015 IECC to refer to a continuous passageway for the transmission of air, composed of ducts and other required accessories.

(o) Eave. DOE would define the term ''eave,'' which is not defined in the 2015 IECC or the HUD Code, to ensure specificity with the proposed prescriptive standards under §§ 460.103(a) and 460.104.

(p) Equipment. DOE proposes to define the term ''equipment,'' which is not defined in the 2015 IECC or the HUD Code, to add further clarification to the meaning of the proposed prescriptive provisions of this part.

(q) Exterior wall. DOE proposes to adopt the definition of the term ''exterior wall'' from the 2015 IECC and describes walls that enclose conditioned space.

(r) Fenestration. DOE would derive the definition of the term ''fenestration'' from the 2015 IECC, which encompasses both vertical fenestration and skylights. DOE requests comment on whether to amend the definition of ''fenestration'' to include tubular daylighting devices.

(s) Floor. DOE proposes to define the term ''floor,'' which is not defined in the 2015 IECC or the HUD Code, to ensure specificity with the proposed prescriptive standards of part 460.

(t) Glazed or glazing. DOE would define the terms ''glazed'' or ''glazing,'' which are not defined in the 2015 IECC or the HUD Code, to ensure specificity with the proposed prescriptive standards of this Part and for consistency with the meaning of the terms as used in the National Fenestration Rating Council Standard 100–2004.

(u) Infiltration. DOE proposes to adopt the definition of the term ''infiltration'' from the 2015 IECC, which describes the uncontrolled air leakage into a manufactured home.

(v) Insulation. DOE would define the term ''insulation'' to mean material qualifying as ''insulation'' for consistency with the U.S. Federal Trade Commission definition of insulation and to ensure specificity with the proposed standards of part 460.

(w) Manufactured home. DOE proposes to adopt the same definition of ''manufactured home'' as used in the HUD Code in order to ensure consistency among both agencies' regulations.

(x) Manufacturer. As discussed below, the underlying statutory authority for this rulemaking does not define the term ''manufacturer.'' DOE proposes to adopt the definition of the term under the HUD Code to mean any person engaged in the factory construction or assembly of a manufactured home, including any person engaged in import of a manufactured home for resale.

(y) Manual. DOE proposes to define the term ''manual'' to be consistent with the 2015 IECC. As stated in this preamble, the terms ''automatic'' and ''manual'' would differentiate between controls that are operated by impersonal (automatic) and personal (manual) influences.

(z) *R*-value (thermal resistance). DOE would adopt the definition of the term ''*R*-value'' from the 2015 IECC to refer to a defined quantitative measure of the resistance to heat flow of a material or assembly of materials.

(A) Rough opening. The term ''rough opening,'' which is not defined in the 2015 IECC or the HUD Code, would identify the location corresponding to the area of an assembly containing fenestration.

(B) Service hot water. DOE proposes to adopt the definition of the term ''service hot water'' from the 2015 IECC to refer to the supply of hot water for uses other than space or comfort heating, such as for bathing.

(C) Skylight. DOE proposes to define the term ''skylight'' based on the meaning of the term in the 2015 IECC, clarifying that the term includes the entire assembly of glass or other transparent or translucent glazing material and the frame, installed at a slope of less than 60 degrees from the horizontal.

(D) Solar heat gain coefficient (SHGC). DOE would adopt the definition of the term ''solar heat gain coefficient'' from the 2015 IECC. SHGC is an important property of transparent or translucent fenestration that affects the heat gain and loss of the building thermal envelope. The SHGC of a fenestration assembly is defined as the ratio of the amount of solar heat gain transmitted or reradiated through the assembly to the amount of incident solar radiation.

(E) State. The term ''state'' would include each of the 50 states, the District of Columbia, the Commonwealth of Puerto Rico, Guam, the U.S. Virgin Islands, and American Samoa.

(F) Thermostat. DOE proposes to adopt the definition of the term ''thermostat'' from the 2015 IECC to describe automatic control devices used to maintain a given temperature.

(G) *U*-factor (thermal transmittance). DOE would adopt the definition of the term ''*U*-factor'' from the 2015 IECC to refer to a defined quantitative measure of the transmittance of heat of a material or assembly of materials.

(H) U_o (overall thermal transmittance). DOE proposes to define the term U_o (overall thermal transmittance), which is not defined in the 2015 IECC or HUD Code, as the coefficient of heat transmission (air to air) through the entire 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.

(I) Ventilation. DOE proposes to adopt the definition of the term ''ventilation'' from the 2015 IECC to refer to the supply or removal of air from any space by natural or mechanical means.

(J) Vertical fenestration. DOE would adopt the definition of the term ''vertical fenestration'' from the 2015 IECC to include materials, such as windows and doors that may be glazed or opaque, installed at an angle of greater than or equal to 60 degrees from horizontal.

(K) Wall. DOE proposes to define the term ''wall,'' which is not defined in the 2015 IECC or the HUD Code, to ensure specificity with the proposed standards under this Part.

(L) Whole-house mechanical ventilation system. DOE proposes to adopt the definition of the term ''whole-house mechanical ventilation system'' from the 2015 IECC to refer to a mechanical system that is designed to exchange indoor air with outdoor air either periodically or continuously.

(M) Window. DOE proposes to define the term ''window,'' which is not defined in the 2015 IECC or the HUD Code, to ensure specificity with the proposed standards under this part.

(N) Zone. DOE would adopt the definition of the term ''zone'' from the 2015 IECC to apply to controls within a manufactured home and to refer to a space or group of spaces within a manufactured home with sufficiently similar requirements for heating and cooling that can be maintained using a single controlling device.

DOE would not include certain definitions that are contemplated in the 2015 IECC, including ''above-grade wall,'' ''addition,'' ''alteration,'' ''approved,'' ''approved agency,'' ''basement wall,'' ''building,'' ''building site,'' ''C-factor,'' ''code official,'' ''commercial building,'' ''conditioned floor area,'' ''continuous insulation,'' ''curtain wall,'' ''demand recirculation water,'' ''DOE,'' ''energy analysis,'' ''energy cost,'' ''energy simulation tool,'' ''energy rating index (ERI) reference design,'' ''fenestration product,'' ''site-built,'' ''F-factor,'' ''heated slab,'' ''high-efficacy lamps,'' ''historic building,'' ''insulating sheathing,'' ''insulated siding,'' ''labeled,'' ''listed,'' ''low-voltage lighting,'' ''proposed design,'' ''rated design,'' ''readily accessible,'' ''repair,'' ''reroofing,'' ''residential building,'' ''roof assembly,'' ''roof recover,'' ''roof repair,'' ''roof replacement,'' ''standard reference design,'' ''sunroom,'' ''thermal envelope,'' ''thermal isolation,'' ''ventilation air,'' and ''visible transmittance.'' These terms are either not relevant to manufactured housing or not relevant to the energy conservation requirements proposed in this subpart.

DOE requests comment on each of the proposed definitions and seeks input on the need for additional clarification to ensure consistency among the HUD Code and general industry practice.

(c) § 460.3 Materials Incorporated by Reference

DOE proposes to incorporate certain materials by reference in the proposed rule, including 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). ACCA Manuals J and S would be incorporated by reference in accordance with § 460.205 of this subpart and would relate to the selection and sizing of heating and cooling equipment. The Battelle Method is an industry standard methodology for calculating the overall thermal transmittance of a manufactured home. The Battelle method currently is referenced in the HUD Code for calculation of overall thermal transmittance. To maintain consistency with the practices of the manufactured home industry, DOE has determined these materials are appropriate for inclusion in the proposed rule.

2. Subpart B: Building Thermal Envelope

DOE proposes to establish energy conservation standards for manufactured housing based on the size and geographic location of a home, as doing so would allow DOE to capture a more accurate balance between energy conservation and cost-effectiveness in developing its standards. For example, manufactured homes frequently are identified by size, including single-section and multi-section homes. Manufactured homes of varying size are capable of reaching different levels of energy conservation based on the ratio of floor square footage to building thermal envelope surface area. A single energy conservation standard for manufactured homes of all sizes thus would be more difficult to achieve in a single-section homes as compared to a multi-section home. Consistent with the recommendations of the MH working group, DOE proposes to establish different standards for manufactured homes located in different regions of the country and for manufactured homes of different size. Subpart B reflects DOE's proposed approach in this regard, and DOE requests comment in this regard.

(a) § 460.101 Climate Zones

Pursuant to EISA, DOE may consider basing its energy conservation standards on the climate zones established by HUD rather than on the climate zones contained in the IECC. *See* 42 U.S.C. 17071(b)(2)(B). The potential for climatic differences to affect energy consumption supports an approach in which energy conservation standards account for geographic differences in climate. For example, the appropriate level of insulation for a manufactured home located in southern Florida would not necessarily be appropriate for a manufactured home located in New Hampshire.

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. Conversely, as indicated in Figure III.2, section R301.1 of the 2015 IECC divides the country into eight climate zones, the boundaries of which are separated along county lines. The 2015 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 climate zones were developed to be sensitive to the manner in which the manufactured housing industry constructed and placed manufactured homes into the market. The 2015 IECC climate zones are separated along county lines to reflect a more accurate 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.

Figure III.1 Climate Zones in the HUD Code

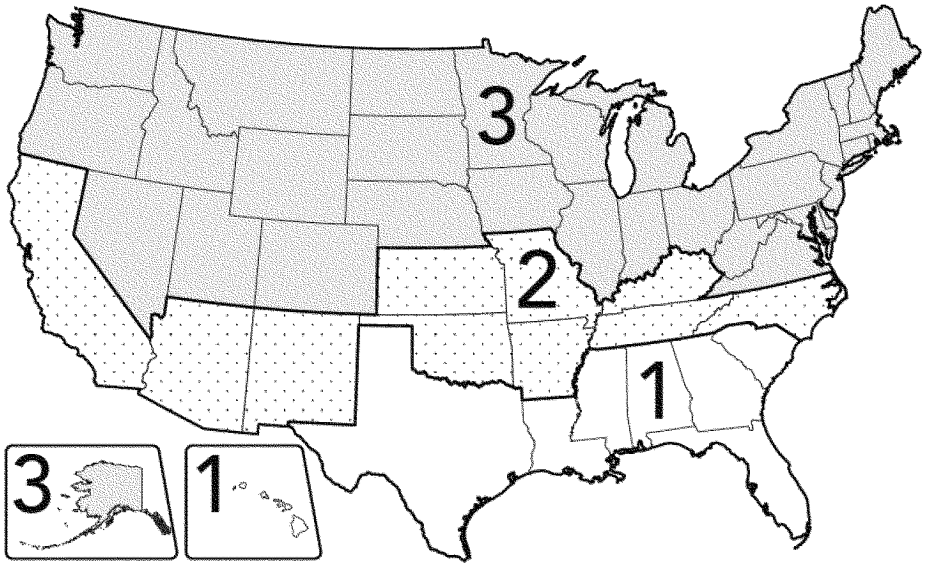
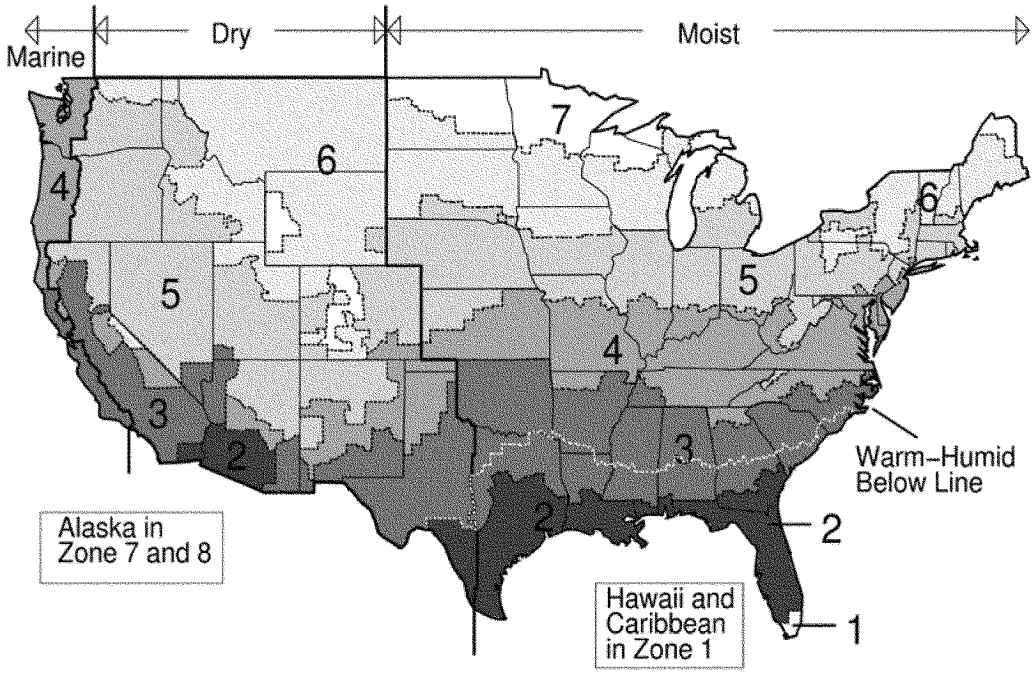


Figure III.2 Climate Zones in the 2015 IECC

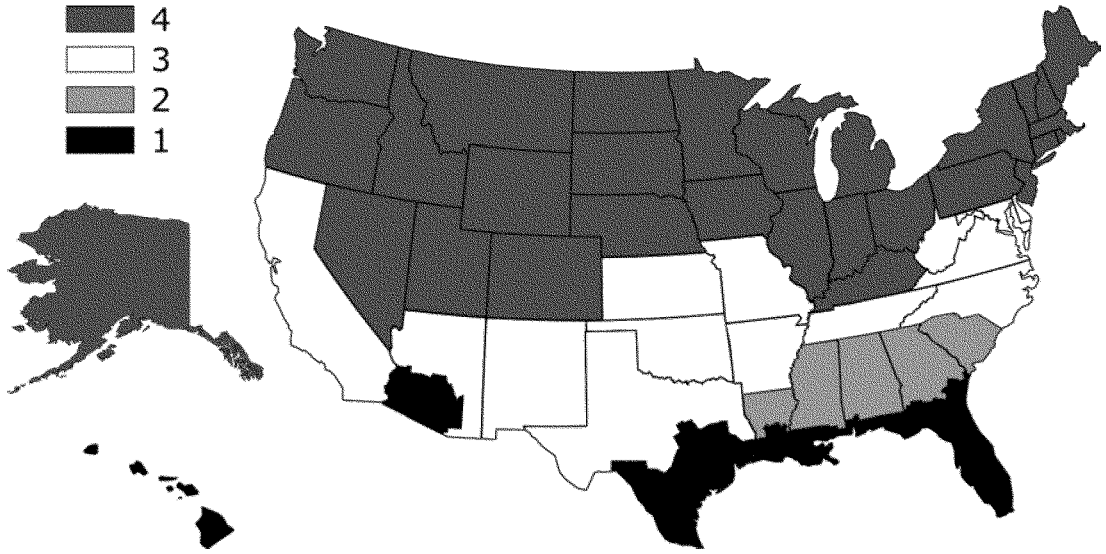


The 2015 IECC includes climate zone-specific prescriptive energy conservation specifications for the building thermal envelope. In accounting for the design and factory construction techniques for manufactured homes, the MH working group recommended that DOE perform a LCC analysis on various cities located in each of the 2015 IECC climate zones. The MH working group also recommended that DOE incorporate into

its LCC analysis several alternatives to certain 2015 IECC prescriptive specifications, including alternative levels of insulation in ceilings, walls, and floors.

DOE calculated the LCC for various alternatives to the 2015 IECC prescriptive specifications for 19 cities, representing a geographically diverse set of climates, with at least one city in each of the 2015 IECC climate zones. As discussed in greater detail in section III.B.2.b of this document and chapters 6 and 8 of the TSD, DOE's LCC analysis demonstrated that common building thermal envelope requirements for multiple groups of cities proved to be most cost-effective. After reviewing DOE's LCC analysis, the MH working group recommended 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. The MH working group found that a four climate zone approach would improve upon the HUD Code climate zones with regard to energy conservation by more accurately distinguishing among regions with similar climates while simultaneously minimizing the extensive subdivisions of states found in the 2015 IECC. Consistent with the recommendations of the MH working group [4] and as illustrated in Figure III.3, § 460.101 would establish a new climate zone arrangement that reflects the advantages of both the HUD Code and the 2015 IECC climate zones. *See* Term Sheet at 2.

Figure III.3 Proposed Climate Zones



If DOE's proposed energy conservation standards adopted the eight climate zones established in the 2015 IECC, 40 states would be divided into two or more climate zones. Although the 2015 IECC climate zones more precisely account for climatic conditions that affect energy use in the United States, any loss of accuracy in addressing climatic differences is negligible compared to the impracticality to the manufactured housing industry of designing and constructing manufactured homes that comply with eight different sets of climate zone requirements and planning home shipments based on individual states with multiple climate zones. A large number of climate zones, particularly within a state, would burden the manufactured housing industry because manufacturers are not always certain of the eventual destination of a home during the manufacturing process. That is, although some manufactured homes are custom orders where the destination is known prior to manufacture, many other manufactured homes are stocked as inventory with manufactured housing dealers. In particular, manufactured housing dealers and installers in states with multiple climate zones would encounter increased complexities associated with ordering, stocking, selling, installing, and servicing manufactured homes.

Although DOE generally prioritized establishment of a single climate zone per state where appropriate, the size or varied climate of certain states necessitated two climate zones in some instances. DOE's proposed climate zones bifurcate Texas, Louisiana, Alabama, Mississippi, Georgia, and Arizona. Data indicates that the inland climate of Texas, Louisiana, Alabama, Mississippi, and Georgia varies significantly from these states' coastal climates along the borders of the Gulf of Mexico. Similarly, southwestern Arizona exhibits different weather patterns from the rest of the state.

DOE requests comment on the proposal to establish four climate zones as well as input with regard to categorization of states and counties that comprise each climate zone. To the extent that a particular approach is advocated, commenters also should provide analyses and data on the potential impact to the costs and benefits of the proposed rule. DOE also requests comment on the need for additional training of state and local building officials who must be familiar with the requirements of two rather than one climate zone.

[4] The term sheet named the four climate zones 1A, 1B, 2, and 3. DOE proposes to rename these climate zones as 1 (former climate zone 1A), 2, (former climate zone 1B), 3 (former climate zone 2), and 4 (former climate zone 3).

(b) § 460.102 Building Thermal Envelope Requirements

Section 460.102 would establish requirements related to the building thermal envelope, which includes 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. As discussed in this preamble, § 460.102(a) would establish two approaches to ensure that the building thermal envelope would meet more stringent energy conservation levels: A prescriptive option and a maximum U_o option.

In developing recommendations under this section, the MH working group carefully considered section R402.1 of the 2015 IECC, which sets forth two primary compliance pathways. First, sections R402.1.2 and R402.1.4 of the 2015 IECC contain climate zone-specific prescriptive building thermal envelope component *R*-value requirements, prescriptive fenestration *U*-factor requirements, and prescriptive SHGC requirements. Second, section R402.1.5 of the 2015 IECC provides 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 singular total *UA* value [5] that is less than or equal to the sum of the component *U*-factor requirements under section R402.1.4 multiplied by the surface area of the building thermal envelope components. The first option is referred to as a ''prescriptive-based approach'' and the second option is referred to as a ''performance-based approach.''

DOE considered developing proposed requirements in line with either a prescriptive-based approach or a performance-based approach for specific assemblies that comprise the building thermal envelope. Ultimately, however, and consistent with the recommendation of the MH working group, DOE determined that allowing manufacturers to choose between two pathways for compliance would realize cost-effective energy savings for homeowners while providing for flexibility within the manufactured housing industry. *See* Term Sheet at 3–4.

The prescriptive approach would establish specific component *R*-value, *U*-factor, and SHGC requirements, providing a straightforward option for construction planning. This pathway would facilitate the ease of compliance but would restrict manufacturer flexibility in making trade-offs, such as increasing insulation levels in some building thermal envelope components while decreasing insulation levels in other building thermal envelope components.

In contrast, the performance-based approach would allow a manufactured home to be constructed using a variety of different materials with varying thermal properties so long as the building thermal envelope achieved a required level of overall thermal performance. The performance-based approach thus would provide manufacturers with greater flexibility in identifying and implementing cost-effective approaches to building thermal envelope design. The performance-based approach is familiar to the manufactured housing industry, as this approach is the basis for the building thermal envelope requirements under the HUD Code. The proposed performance-based requirements would be intended to be functionally equivalent to the prescriptive-based requirements in that both options would result in manufactured homes with approximately the same amount of energy use.

DOE requests comment on the proposal to set forth prescriptive and performance options for the purpose of compliance with the proposed building thermal envelope requirements. In particular, DOE requests comment on the requirements of each pathway as well as their equivalency in terms of overall thermal performance.

The proposed prescriptive building thermal envelope requirements under § 460.102(b) are stated in terms of minimum *R*-value and maximum *U*-factor and SHGC requirements. The MH working group recommended the prescriptive values set forth in Table III.3 that DOE has adopted in this rulemaking by assessing and revising the 2015 IECC specifications to ensure cost-effectiveness based on the impact on the purchase price of manufactured homes and on total lifecycle construction and operating costs. *See* Term Sheet at 3.

TABLE III.1—PROPOSED BUILDING THERMAL ENVELOPE PRESCRIPTIVE REQUIREMENTS

Climate zone	Ceiling *R*-value	Wall *R*-value	Floor *R*-value	Window *U*-factor	Skylight *U*-factor	Door *U*-factor	Glazed fenestration SHGC
1	30	13	13	0.35	0.75	0.40	0.25.
2	30	13	13	0.35	0.75	0.40	0.33.
3	30	21	19	0.35	0.55	0.40	0.33.
4	38	21	30	0.32	0.55	0.40	No Rating.

As discussed in greater detail in chapter 6 of the TSD, DOE developed the requirements included in § 460.102(b), as illustrated in Table III.1, by evaluating the cost-effectiveness of the 2015 IECC building thermal envelope specifications and alternatives to these specifications. DOE performed LCC analysis for all alternatives to the 2015 IECC specifications that were recommended by the MH working group, in order to assist in the development of cost-effective standards under this rule.

The MH working group requested that DOE evaluate variations in the *R*-value requirement for ceilings, walls, and floors, and the *U*-factor requirement for windows, to determine the impact on cost-effectiveness relative to the 2015 IECC requirements. Upon analyzing a range of ceiling insulation requirements from *R*-22 to *R*-38, wall insulation requirements from *R*-13 to *R*-21, floor insulation requirements from *R*-13 to *R*-38, and window U-factor requirements from 0.40 to 0.31, DOE has proposed the most cost-effective energy conservation requirement for each climate zone, as included in Table III.1.

The MH working group also requested that DOE conduct sensitivity analyses of window SHGC. *See* Term Sheet at 3. In climate zone 1, DOE analyzed a range of window SHGC from 0.25 to 0.40. DOE is proposing the most cost-effective

[5] Total *UA* is a metric that is very similar to U_o that typically is used in the context of site-built construction. Section R402.1.5 of the 2015 IECC uses the metric ''total *UA*,'' which denotes the sum of each building thermal envelope component's *U*-factor multiplied by the assembly area of the component. This metric is referred to as ''U_o'' in the manufactured housing industry and serves the same function as ''total *UA*.''

SHGC requirement for climate zone 1, as included in Table III.1. In climate zone 4, the MH working group requested that DOE not run sensitivity analyses for different SHGC options for most cities found in climate zone 4. SHGC has a smaller impact on energy use in regions dominated by heating rather than cooling loads. In these locations, more stringent SHGC requirements can lead to increased energy consumption by blocking the solar heating effects of sunlight. For these reasons, the MH working group proposed to not modify the 2015 IECC specification of no requirement, and DOE is incorporating the 2015 IECC specification of no SHGC requirement for proposed climate zone 4. Please see chapter 6 of the TSD for additional detail on DOE's SHGC sensitivity analyses.

The MH working group also recommended that DOE perform a sensitivity analysis of the total cost of ownership to determine the most cost-effective SHGC for climate zones 2 and 3. *See* Term Sheet at 3. DOE recognizes that many variables affecting the selection of recommended SHGC values were discussed by the MH working group over the course of multiple public meetings. At the recommendation of the MH working group, DOE studied the potential economic impacts of several SHGC values with the intent of proposing prescriptive SHGC requirements that provide the greatest economic benefit. Economic impact was the primary decision tool used in proposing prescriptive SHGC values, and DOE has prepared an economic analysis that supports different SHGC requirements for climate zones 2 and 3. DOE specifically found that an SHGC of 0.30 was the most cost-effective SHGC value based on a 10-year cost of ownership savings calculation. *See* 80 FR 7550. In arriving at this value, DOE placed all windows on one side of the manufactured home, with the windows facing west. DOE used this window orientation in its sensitivity analysis in order to arrive at SHGC values that would have the greatest impact on energy savings. DOE sought public input on this methodology and analysis in the 2015 RFI. *See* 80 FR 7550.

In response to the 2015 RFI, several commenters stated that factors other than total cost of ownership should be considered when proposing a prescriptive SHGC requirement. One commenter suggested that the total cost of ownership analysis should not be the sole consideration for choosing the SHGC requirement and that DOE should consider the 2015 IECC SHGC specifications, lifecycle costs, potential impacts on the purchase price of manufactured housing, air conditioner down-sizing and cost savings opportunities, reductions in peak electric loads, and manufacturer benefits in harmonizing SHGC across climate zones. Another commenter suggested that equipment downsizing, reduction in peak demand, improved occupant comfort leading to behavioral changes in adjusting a thermostat, synchronizing with the 2015 IECC, and lifecycle costs should be considered as a basis for the proposed SHGC requirements. The commenter also recommended that an SHGC of 0.25 in climate zones 1, 2, and 3 would be beneficial, as doing so would establish only two window requirements (SHGC of 0.25 in climate zones 1, 2, and 3; and no SHGC requirement for climate zone 4) and would simplify and streamline the purchasing of windows for manufacturers of manufactured homes.

Other commenters noted that placing all windows on one side of a manufactured home with the assumption that all windows face west was an atypical assumption. The commenters suggested that window orientation should follow the same ''industry average'' convention used in all other assumptions used in DOE's SHGC analysis. The commenters presented analysis based on their assessment of industry averages to demonstrate that such assumptions would support an SHGC requirement of 0.33; however, this analysis included assumptions that differed from those agreed upon by the MH working group, including window-to-floor area, window shading, and window cost. The commenters also noted that a group of windows with a weighted SHGC of 0.30 would require a mixture of window products of dissimilar aesthetic. Finally, the commenters believed that the likely industry response to a 0.30 SHGC requirement would be to assemble manufactured homes with a single window product SHGC value closer to 0.25. DOE also received a comment that supported the window orientation that DOE employed in its analysis, recommending that the analysis properly based SHGC assumptions on window orientation that would experience the highest energy use.

In response to the aforementioned comments, DOE determined that the window orientation assumption used in its SHGC analysis was inconsistent with other analytical assumptions under the proposed rule, as a more representative SHGC analysis would place windows uniformly on all sides of a manufactured home. Although the assumption of all windows facing west represents the highest energy use window orientation, manufactured homes with other window orientations would not experience as large an economic benefit. DOE also found no reason to deviate from the other assumptions in the submitted analysis (window-to-floor area, window shading, and window cost) that formed the basis of the MH working group's deliberations and recommendations. Finally, DOE notes that factors such as lifecycle costs, potential impacts on the purchase price of manufactured housing are included in its analysis.

DOE did not include air conditioner down-sizing and cost savings opportunities in its SHGC analysis. Although in some instances a manufacturer may be able to install a smaller air conditioner, for example, leading to reduced energy costs and a lower purchase price, this is not always possible. DOE did not prioritize peak electric load reduction over lifecycle cost savings to individual manufactured homeowners under its analysis. Finally, while equivalent SHGC requirements across climate zones could simplify window procurement for manufacturers, DOE notes that manufacturers could elect to use the same window types for manufactured homes shipped to any climate zone in accordance with the proposed rule.

DOE repeated its SHGC sensitivity analysis of climate zones 2 and 3 using a uniform window orientation to study the economic impacts of SHGC values of 0.25, 0.30, and 0.33. This analysis indicated SHGC of 0.33 had the greatest total cost of ownership savings; therefore, DOE proposes requiring SHGC of 0.33 in climate zones 2 and 3. Because the sensitivity analysis performed for climate zone 1 during the negotiated consensus process used the original assumption of uniform window distribution, this analysis was not repeated for climate zone 1.

For skylight *U*-factor requirements, the MH working group did not request that DOE evaluate the effect of variations of the 2015 IECC requirements on cost-effectiveness. Because there were LCC savings associated with the 2015 IECC requirements, DOE is proposing to adopt the 2015 IECC *U*-factor requirements for skylights into the proposed rule. This proposal is consistent with the recommendation of the MH working group. *See* Term Sheet at 3.

For door *U*-factor requirements, DOE found that a manufactured home with a *U*-factor of 0.40 was cost-effective. Therefore, DOE proposes a prescriptive door *U*-factor requirement of 0.40 in all climate zones for the proposed rule.

This proposal is consistent with the recommendation of the MH working group. *See* Term Sheet at 3.

Section 460.102(b)(2) as proposed would require the truss heel height to be a minimum of 5.5 inches at the outside face of each exterior wall for the purpose of compliance with the prescriptive ceiling insulation *R*-value requirement established under § 460.102(b)(1). This minimum heel height requirement would ensure that a minimum space is available in the eaves of the ceiling, allowing for adequate insulation coverage near the eaves. This proposal is also consistent with the recommendation of the MH working group. *See* Term Sheet at 3.

Section 460.102(b)(3) would authorize manufacturers to install ceiling insulation with either a uniform thickness or a uniform density. In many cases, a ceiling may need to be filled with loose blown insulation to a greater height at the center of the ceiling relative to the edges near the eaves to meet average overall *R*-value requirements. Although uniform insulation thickness is not required under the proposed standard, the 5.5-inch minimum truss heel height encourages a minimum insulation thickness at the eaves. This proposal is also consistent with the recommendations of the MH working group. *See* Term Sheet at 3.

Section 460.102(b)(4) would authorize manufacturers to use a combination of *R*-21 batt insulation and *R*-14 blanket insulation in lieu of *R*-30 insulation for the purpose of compliance with the climate zone 4 floor insulation *R*-value requirement under paragraph (b)(1) of this section. This requirement would reflect industry practice in which manufactured homes often do not have space in the floor to accommodate *R*-30 insulation without compression. DOE thus proposes that *R*-21 batt insulation plus *R*-14 blanket insulation would be deemed compliant with the *R*-30 requirement in order to provide a prescriptive alternative for space-constrained floors. This proposal is also consistent with the recommendation of the MH working group. *See* Term Sheet at 3.

Section 460.102(b)(5) would authorize manufacturers to exclude from the SHGC requirements under § 460.102(a) any individual skylight with an SHGC that is less than or equal to 0.30. This requirement effectively would establish an exception for skylights to the SHGC requirements in climate zone 1, setting forth a maximum skylight SHGC requirement of 0.30. This exception is set forth in the 2015 IECC in footnote ''b'' to Table R402.1.2. The MH working group recommended that DOE retain this requirement, and DOE agrees with including this exception in the proposed rule. *See* Term Sheet at 3.

DOE also considered the potential impact of adopting sections R402.3.3 and R402.3.4 of the 2015 IECC in this rulemaking. Section R402.3.3 specifies that 15 square feet of glazed fenestration may be exempt from SHGC and *U*-factor requirements. DOE proposes not to adopt this requirement because the prescriptive fenestration SHGC and *U*-factor requirements would apply to all fenestration. Given that 15 square feet represents a large portion of the overall fenestration area that comprises a manufactured home, adoption of this requirement potentially would exclude from these requirements a significant source of energy conservation. Section R402.3.4 of the 2015 IECC exempts one side-hinged opaque door of up to 24 square feet in surface area from the 2015 IECC *U*-factor requirements. DOE has not adopted section R402.3.4 of the 2015 IECC, as excluding these types of doors from this proposed rulemaking also would represent the loss of a significant source of home energy conservation.

Section R402.5 of the 2015 IECC specifies maximum *U*-factor requirements for sunroom fenestration. Because sunrooms are not commonly offered in manufactured housing, DOE determined this section was not applicable to manufactured housing and proposes not to include sunroom fenestration requirements in this proposed rule.

Section 460.102(b)(6) would establish maximum *U*-factor values as alternatives to the minimum *R*-value requirements established under § 460.102(a). *See* Term Sheet at 5. DOE determined each proposed *U*-factor alternative by calculating the *U*-factor corresponding to a building component (*e.g.,* wall) with typical dimensions and construction using the insulation material *R*-value specified in Table III.1. More detail on establishing the proposed *U*-factor alternatives is provided in chapter 7 of the TSD. DOE notes that the proposed *U*-factor alternatives are based on a representative single-section manufactured home, which are an average of 4.2 percent higher than the corresponding calculations of *U*-factor alternatives using the dimensions of a representative multi-section manufactured home.

DOE requests comment on the *U*-factor alternatives and their equivalency with the *R*-value requirements for ceiling, wall, and floor insulation. Specifically, DOE invites comment on the use of *U*-factor alternatives for ceiling insulation based on a conversion calculation using a representative single-section manufactured home.

Section 460.102(b)(7) would establish a maximum ratio of 12 percent for glazed fenestration area to floor area. As discussed in further detail in chapter 7 of the TSD, DOE used this ratio as a typical housing characteristic in its analyses for determining the prescriptive requirements. Manufactured homes with window to floor area greater than 12 percent would use more energy (all else held equal), because glazed fenestration generally has a greater *U*-factor than other building components (such as walls). Although this requirement limits the amount of glazed fenestration in a manufactured home when a manufacturer is using the prescriptive requirements for compliance with the proposed rule, a manufacturer may instead follow the performance-based requirements for compliance if they wish to increase the area of glazed fenestration (in exchange for increasing the performance of other building thermal envelope components).

The proposed performance-based requirements under § 460.102(c) are stated in terms of maximum U_o of the entire building thermal envelope as a function of climate zone. The U_o requirements proposed in § 460.102(c) were determined by applying the proposed prescriptive building thermal envelope requirements under § 460.102(b) to manufactured homes using typical dimensions and construction techniques and then calculating the resultant U_o. See chapter 7 of the TSD for more detailed information on the typical dimensions of manufactured homes and the Battelle Method for more detailed information on the calculation of U_o.

As discussed in chapter 7 of the TSD, the proposed maximum U_o for a multi-section manufactured home was calculated by assuming a 1,568-square-foot double-section manufactured home. The proposed maximum U_o for a single-section manufactured home was calculated by assuming a 924-square-foot single-section manufactured home. Both multi- and single-section home U_o values were calculated assuming manufactured homes built with wood framing and a window area equal to 12 percent of the floor area. DOE's proposed approach to determining U_o is consistent with HUD's approach to determining U_o under the HUD Code (*see* 24 CFR 3280.507(a)), and is very similar to the ICC's approach to determining total *UA* under section R402.1.5 of the 2015 IECC. DOE believes

that its approach to determining U_o would reduce the compliance burden on manufacturers by avoiding the need for manufacturers to perform two separate calculations under both the HUD Code and the DOE requirements.

Section R402.5 of the 2015 IECC includes specifications for maximum allowable fenestration *U*-factors when following the performance-based approach. The 2015 IECC specifies a maximum area-weighted average *U*-factor of 0.48 in IECC climate zones 4 and 5 for vertical fenestration, a maximum area-weighted average *U*-factor of 0.40 for IECC climate zones 6 through 8 for vertical fenestration, and a maximum area-weighted average *U*-factor of 0.75 for skylights in IECC climate zones 4 through 8. Consistent with the recommendations of the MH working group (*see* Term Sheet at 1), DOE proposes to adopt these requirements under §§ 460.102(c)(2) and 460.102(c)(3) by limiting area-weighted vertical fenestration *U*-factor to 0.48 in climate zone 3, limiting area-weighted vertical fenestration *U*-factor to 0.40 in climate zone 4, and limiting area-weighted skylight *U*-factor to 0.75 in climate zones 3 and 4. Sections 460.102(c)(2) and 460.102(c)(3) would serve the purpose of limiting the extent to which window performance can be traded off for improved performance in other components of a manufactured home and would prevent areas of a manufactured home that are located in close proximity to vertical fenestration and skylights from being subject to excessive rates of heat loss.

Finally, § 460.102(c)(4) would require 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 and seeks to ensure flexibility among manufacturers that choose to use unique glazed fenestration products that otherwise would not meet the SHGC requirement individually. This proposal is also consistent with the recommendations of the MH working group. *See* Term Sheet at 4.

DOE invites comment on proposal to include an area-weighted average calculation of SHGC for compliance with § 460.102(c). DOE also requests comment on all other prescriptive and performance requirements proposed in this section. To the extent that a commenter supports the proposed requirements or suggests alternative building thermal envelope criteria, DOE is specifically interested in data and calculations that would support the commenter's position.

Section 460.102(d) would establish procedures for ensuring compliance with the prescriptive building thermal envelope standards under § 460.102(b). As discussed in this preamble, however, the MH working group did not address options for systems of compliance and enforcement, and DOE has not included proposed compliance and enforcement provisions in rule. In the event that DOE addresses compliance assurance in a future rulemaking, paragraphs (d)(1), (d)(2), (d)(4), (d)(5), and (d)(7) would be reserved to provide a methodology for calculating the *R*-value of insulation; the *R*-value of non-insulating materials; fenestration *U*-factor; the *U*-factor of walls, ceilings, and floors; and glazed fenestration SHGC that would provide for an accurate and repeatable procedure to determine compliance with the standards proposed under § 460.102(b).

Section 460.102(d)(3) would establish that the total *R*-value of a component is the sum of the *R*-values of each layer of insulation that compose the component. This proposed requirement is consistent with section R402.1.3 of the 2015 IECC, which specifies that component insulation materials installed in layers has a total *R*-value equal to the sum of the *R*-values of each layer.

Sections 460.102(d)(6) and 460.102(d)(8) would authorize manufacturers to determine *U*-factor or SHGC for certain fenestration products and doors in accordance with the prescriptive default values set forth in Tables 460.102–4, 460.102–5, and 460.102–6. DOE anticipates that a manufacturer could rely on these prescriptive default *U*-factor values to facilitate the ease of compliance with this proposed rule. DOE has designed proposed § 460.102(d)(6) for consistency with Tables R303.1.3(1), R303.1.3(2), and R303.1.3(3) of the 2015 IECC and in accordance with the MH working group's recommendations. DOE has proposed conservative prescriptive default values to provide an incentive to manufacturers to determine the actual performance value of the windows, doors, or skylights installed in a manufactured home. DOE expects the default tables would be used primarily in instances in which the actual performance value of a window, door, or skylight is unavailable or unknown.

Section 460.102(e) would establish procedures for ensuring compliance with the building thermal envelope U_o standards under § 460.102(c). As discussed in this preamble, the MH working group did not address options for systems of compliance and enforcement, and DOE has not included proposed compliance and enforcement provisions in this proposed rule. In the event that DOE addresses compliance assurance in a future rulemaking, paragraphs (e)(1)(i), (e)(1)(ii), and (e)(2) would be reserved to provide a methodology for calculating the *R*-value of insulation, the *R*-value of non-insulating materials, and glazed fenestration SHGC that would provide for an accurate and repeatable procedure to determine compliance with the standards proposed under § 460.102(c).

The MH working group recommended, however, that U_o be determined in accordance with the ''Battelle Method.'' The Battelle Method is an industry standard methodology for determining U_o and is commonly utilized in the manufactured home industry. The Battelle Method's methodology is based on recommendations in the ASHRAE Handbook of Fundamentals but provides more specificity to determining U_o for manufactured housing. The Battelle Method provides a step-by-step process for calculating U_o by calculating the *U*-value of each unique area of the building thermal envelope and by calculating a weighted average. Both of these references serve as the basis for calculating overall thermal transmittance under the HUD Code (*see* 24 CFR 3280.508) while only the ASHRAE Handbook of Fundamentals is referenced in section R402.1.5 of the 2015 IECC.

Finally, § 460.102(e)(3) would authorize manufacturers to determine the SHGC of certain glazed fenestration products in accordance with the prescriptive default values set forth in Table 460.102–6 for consistency with the rationale accompanying § 460.102(d)(8) of this section. Table 460.102–6 differentiates between single- and double-pane windows, glazed block windows, as well as clear and tinted glass. Single- and double-pane windows refer to the number of panes of glass that are in the window assembly. A single-pane window consists of one pane of glass while a double-pane window consists of two panes of glass separated within the window assembly at a fixed distance. The space between the two panes of glass serves to reduce heat transfer through the window. A glazed block window refers to a window assembly that consists of glass blocks that are arranged or laid out like bricks. These types of windows cannot be opened and are typically used in ground level or basement floors for security purposes. The terms ''clear'' and ''tinted'' glass characterize the light transmission properties of the glass. Clear glass is uncoated and transparent,

admitting all light through its body. Tinted glass instead has an altered chemical composition or surface coating that affects light transmission and color. Different types of tinted glass block and reflect different quantities and types of light. Table 460.102–6 provides proposed default SHGC values for these different types of windows.

(c) § 460.103 Installation of Insulation

Section 460.103(a) would require manufacturers to install insulation according to both the insulation manufacturer's installation instructions and the instructions set forth in Table 460.103. DOE proposes to require manufacturers to comply with the insulation manufacturer's installation instructions both for consistency with section R303.2 of the 2015 IECC and to ensure that the intended performance of the insulation is achieved. Unlike section R303.2 of the 2015 IECC, however, § 460.103 would not require insulation to be installed in accordance with the International Building Code or the International Residential Code, as the HUD Code already sets forth requirements in this regard. DOE also proposes additional insulation requirements under § 460.103(a) that are based in part on section R402.4.1.1 of the 2015 IECC, with clarifications to account for the unique design of manufactured homes, to ensure that insulation is able to achieve its intended thermal performance.

Table 460.103 would include a general requirement that air-permeable insulation must not be used as a material to establish the air barrier. This proposed requirement is consistent with Table R402.4.1.1 of the 2015 IECC, which the MH working group recommended that DOE include this in the proposed rule. *See* Term Sheet at 1. DOE proposes to adopt this requirement to improve energy conservation in manufactured housing through the reduction of natural air infiltration through the building thermal envelope.

Proposed Table 460.103 also includes insulation requirements for access hatches, panels, and doors between conditioned space and unconditioned space. Section 460.103(a) would require each access hatch, panel, and door leading from conditioned space to unconditioned space to be insulated to a level equivalent to the level of insulation immediately adjacent to the access hatch, panel, and door. This requirement would ensure that the thermal performance of the access hatch, panel, or door would be identical to the surrounding ceiling and would ensure that the ceiling insulation achieves the same level of performance as ceiling insulation without an access hatch, panel, or door. Section 460.103(a) also would require each access hatch, panel, and door to provide access to all equipment without damaging or compressing the insulation. Damaging or compressing the insulation would reduce the performance of the insulation and increase the energy losses associated with the ceiling. Finally, each access hatch, panel, and door must be equipped with a wood-framed or equivalent baffle or retainer when loose fill insulation is installed within a ceiling assembly to retain the insulation on the access hatch, panel, or door. That is, an access hatch, panel, or door must use baffles or a retainer to prevent loose-fill insulation installed within a ceiling assembly from spilling into the living space upon use of the access hatch, panel, or door. Each of these requirements have been adopted from section R402.2.4 of the 2015 IECC are consistent with the recommendations of the MH working group, and seek to preserve the performance of insulation within a manufactured home. *See* Term Sheet at 1.

Section R402.2.4 of the 2015 IECC also includes a specification for vertical doors that provide access from conditioned to unconditioned spaces to meet certain fenestration insulation requirements. The MH working group recommended not adopting this specification in the proposed rule because vertical doors that separate conditioned and unconditioned spaces typically are not installed in manufactured homes. Consistent with the recommendation of the MH working group, DOE proposes not to include this requirement in this proposed rule. *See* Term Sheet at 1.

Proposed Table 460.103 includes requirements for installing insulation adjacent to baffles. Baffles must be constructed using a solid material, maintain an opening equal or greater than the size of the eave vent, and extend over the top of the attic insulation. Baffles allow for air circulation from the exterior of the manufactured home to the attic space between the ceiling insulation and the top of the roof. The installation requirement would ensure proper attic ventilation and that insulation would not interfere with a baffle's ability to facilitate air circulation. The proposed requirements would be consistent with section R402.2.3 of the 2015 IECC and the MH working group's recommendations, and would help ensure proper ventilation in attic spaces. *See* Term Sheet at 1.

Table 460.103 as proposed includes a requirement for installing insulation in ceilings or attics. Specifically, the requirement states that insulation installed in any dropped ceiling or dropped soffit must be aligned with the air barrier. The requirement would ensure that there would not be excessive air infiltration through the building thermal envelope if a dropped ceiling or dropped soffit is present in a manufactured home. This requirement is consistent with Table R402.4.1.1 in the 2015 IECC, and the MH working group recommended that DOE include this requirement in the proposed rule. *See* Term Sheet at 1.

To address the unique practice of HVAC duct installation in manufactured homes, Table 460.103 would require insulation to 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. This requirement is generally consistent with section R402.2.8 of the 2015 IECC, which specifies that floor insulation be installed in direct contact with the underside of the subfloor decking. Given that HVAC ducts in manufactured homes generally are located in the floor space between the insulation and the underside of the subfloor decking, DOE would require the same floor insulation requirements as the 2015 IECC while recognizing the need to insulate around HVAC ducts. DOE requests comment on the proposed floor insulation requirement and whether it would be consistent with industry practice.

Table 460.103 as proposed includes an insulation installation requirement associated with narrow cavities such that batts installed in narrow cavities must be cut to fit or filled by insulation that upon installation readily conforms to the available cavity space. This requirement would ensure that all wall cavities are properly insulated, even if they have a non-standard width. This type of narrow cavity could occur in a wall area adjacent to a window frame. This requirement would be consistent with Table R402.4.1.1 of the 2015 IECC, which the MH working group recommended that DOE adopt in the proposed rule. *See* Term Sheet at 1. DOE proposes to include this requirement in the proposed rule because it ensures that all cavities are properly insulated to achieve the expected thermal performance.

Table 460.103 also would require rim joists to be insulated. This requirement would ensure that the entire floor assembly of a manufactured home

achieves the desired thermal performance. The requirement is consistent with Table R402.4.1.1 of the 2015 IECC, and the MH working group recommended that DOE include this requirement in the proposed rule. *See* Term Sheet at 1.

Table 460.103 includes an insulation installation requirement that would require exterior walls adjacent to showers and tubs to be insulated. This proposed requirement is consistent with Table R402.4.1.1 of the 2015 IECC, which the MH working group recommended that DOE adopt in the proposed rule. *See* Term Sheet at 1. DOE proposes to include this requirement in the proposed rule because it would ensure that all wall assemblies with showers and tubs would achieve the expected thermal performance requirements established under § 460.102.

Table 460.103 also would require air permeable exterior building thermal envelope insulation for framed walls to completely fill the wall cavity, including cavities within stud bays caused by blocking lay flats or headers. The requirement clarifies the 2015 IECC requirement for wall insulation installation found in Table R402.4.1.1. The MH working group recommended that DOE modify the language of the 2015 IECC requirement to account for the unique design of manufactured housing. *See* 9/23 Working Group Transcript, EERE–2009–BT–BC–0021–0122 at p. 315. DOE proposes to adopt this requirement, along with the recommended modifications from the MH working group, to ensure that wall assemblies in manufactured homes achieve the proposed thermal performance requirements set forth under § 460.102.

Finally, the 2015 IECC contemplates additional specifications for insulating areas associated with the building thermal envelope that DOE has not included in this proposed rule. For example, section R402.1.1 of the 2015 IECC specifies that wall assemblies in the building thermal envelope comply with the vapor retarder requirements of section R702.7 of the International Residential Code or section 1405.3 of the International Building Code. DOE has not incorporated this requirement into this proposed rule, as this specification is a construction requirement that was not addressed by the MH working group.

Section R402.2.13 of the 2015 IECC establishes sunroom insulation specifications. Sunrooms typically are not commonly installed in manufactured homes; accordingly, DOE has not incorporated this provision of the 2015 IECC into this proposed rule. Similarly, section R402.2.12 of the 2015 IECC specifies that insulation is not required on the horizontal portion of the foundation that supports a masonry veneer. Given that masonry veneers typically are not used in manufactured homes, DOE has not incorporated this provision of the 2015 IECC into this proposed rule

The 2015 IECC also includes building thermal envelope specifications for mass walls, steel-framed buildings, walls with partial structural sheathing, basement and below-grade walls, slab-on grade construction, and crawl space walls in sections R402.2.5, R402.2.6, R402.2.7, R402.2.9, R402.2.10, R402.2.11, respectively. DOE has not included these requirements in the proposed rule because they are not directly relevant to manufactured housing.

(d) § 460.104 Building Thermal Envelope Air Leakage

Section 460.104 would require manufacturers to seal manufactured homes against air leakage in order to ensure the conservation of energy within a manufactured home. Section 460.104 would establish both general and specific requirements for sealing a manufactured home to prevent air leakage, all of which are based on Table 402.4.1.1 of the 2015 IECC and related recommendations from the MH working group. *See* Term Sheet at 5. Unlike the 2015 IECC, the proposed rule would not establish maximum building thermal envelope air leakage rate requirements. The MH working group recommended sealing requirements that would ensure that a home can be tightly sealed with techniques that can be visually inspected, thus minimizing the compliance burden on manufacturers. The MH working group also recommended the adoption of air leakage sealing requirements designed to achieve an overall air exchange rate of 5 ACH within a manufactured home. *See* Term Sheet at 5.

The general requirements in § 460.104 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. These requirements would ensure that there would not be excessive air infiltration through the building thermal envelope and that air seals would be durable through seasonal changes in temperature. Because these requirements would result in reduced energy use through proper air sealing in a manufactured home, DOE proposes to adopt the MH working group's recommendations in the proposed rule. DOE requests comment on the effectiveness of the proposed prescriptive criteria of § 460.104 for the purpose of sealing the building thermal envelope to limit air leakage.

Table 460.104 also would include requirements for establishing an air barrier for specific building components. The proposed requirements included in Table 460.104 for ceilings or attics, duct system register boots, recessed lighting, and windows, skylights, and exterior doors are all consistent with Table R402.4.1.1 of the 2015 IECC. The MH working group recommended that these 2015 IECC-based requirements also be included in the proposed rule. *See* Term Sheet at 1. Because these specifications reduce energy use by helping to ensure proper installation of an air barrier for the applicable building components, DOE proposes to adopt the 2015 IECC specifications as requirements in the proposed rule.

The requirements of Table 460.104 for walls, floors, and electrical boxes or phone boxes on exterior walls are based on specifications included in Table R402.4.1.1 of the 2015 IECC with modifications based on the recommendation of the MH working group. *See* Term Sheet at 1. The 2015 IECC specifications save energy by helping to ensure proper installation of an air barrier, and the MH working group recommended modifications to the specifications based on the unique nature of the manufactured housing industry. Rather than use the term ''air sealed boxes'' from the 2015 IECC, the MH working group described directly how this could be achieved using the phrasing ''the air barrier must be sealed around the box penetration.'' DOE thus proposes to adopt the 2015 IECC specifications, as amended, in the proposed rule.

Table 460.104 also would establish requirements for mating line surfaces, as recommended by the MH working group. *See* Term Sheet at 5. The proposed requirements would ensure proper sealing of the mating line surface between the two sections of a multi-section manufactured home and would reduce energy use by ensuring that multi-section manufactured homes have a continuous air barrier.

The proposed requirements of Table 460.104 for rim joists, and showers or tubs adjacent to exterior walls are consistent with the specifications of Table R402.4.1.1 of the 2015 IECC. The MH working group recommended that DOE adopt the 2015 IECC specifications

in the proposed rule given that they would result in additional energy conservation within a manufactured home by helping to ensure a continuous air barrier. *See* Term Sheet at 1.

Table R402.4.1.1 of the 2015 IECC also contains specifications for air leakage sealing in crawl space walls, garage separation, plumbing and wiring, and concealed sprinklers. The MH working group recommended that DOE not propose these specifications in the proposed rule. *See* Term Sheet at 1. Given that these requirements are not directly applicable to manufactured home construction, DOE is not proposing to include these requirements in the proposed rule.

The 2015 IECC includes specifications for air leakage of fenestration and recessed luminaires that DOE has not included in this proposed rule. In section R402.4.3 of the 2015 IECC, windows, skylights, and sliding glass doors have a specified maximum air leakage rate of 0.3 cubic feet per minute (cfm) and swinging doors have a specified maximum air leakage rate of 0.5 cfm. Section R402.4.5 of the 2015 IECC specifies air leakage around recessed luminaires most be no greater than 2.0 cfm when tested at a 75 pascal pressure differential. The MH working group recommended not to include these requirements for fenestration and recessed luminaire air leakage in order to reduce the testing burden on manufacturers. *See* Term Sheet at 1. DOE agrees with the MH working group's recommendation and has not proposed to include air leakage requirements for fenestration and recessed luminaires, as air leakage standards already are addressed generally at the building thermal envelope level. Nevertheless, DOE has designed its proposed prescriptive building thermal envelope air leakage standards, which include requirements to seal the space between fenestration and framing and between recessed luminaires and drywall, to achieve an air leakage rate of five ACH.

DOE also reviewed section R402.4.4 of the 2015 IECC regarding rooms containing fuel-burning appliances. Section R402.4.4 includes specifications for the placement of fuel-burning appliances (outside of conditioned space), for sealing of the room enclosing the appliance, and for insulation of ducts and waterlines. Although these provisions have potential to save energy, the HUD Code already specifies that the combustion system for fuel burning devices must be completely separated from the interior atmosphere of the manufactured home. *See* 24 CFR 3280.709(d). Therefore, DOE is not including these requirements in this proposed rulemaking. However, DOE may consider the merits of including R402.4.4 in future revisions of energy conservation standards for manufactured housing. DOE requests comment on the fireplace requirements based on section R402.4.2 of the 2015 IECC and the proposal not to include insulation and air sealing requirements pertaining to rooms containing fuel-burning appliances.

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

(a) § 460.201 Duct Sealing

Section 460.201(a) would require manufacturers to equip each manufactured home with a duct system designed to limit total air leakage to less than or equal to four cubic feet per minute per 100 square feet of conditioned floor area, when tested in accordance with § 460.201(b). Section R403.3.4 of the 2015 IECC specifies that the total air leakage of duct systems is to be less than or equal to four cubic feet per minute per 100 square feet of conditioned floor area under a post-construction test. The 2015 IECC also includes specifications for a rough-in test performed with or without an air handler. The MH working group recommended that DOE consider only the post-construction test 2015 IECC specifications in developing the proposed standards given the unique nature of manufactured homes relative to site-built housing. *See* 9/10 Working Group Transcript, EERE–2009–BT–BC–0021–0133 at 227. DOE proposes to adopt the post-construction test specifications of the 2015 IECC as it would be more cost-effective to the manufactured housing industry.

Section R403.3.5 of the 2015 IECC specifies that building framing cavities must not be used as plenums. A plenum is a space within a building that facilitates the circulation of air. 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 practice and is not a typical practice in the manufactured housing industry. Therefore, consistent with the 2015 IECC and the recommendation of the MH working group (*see* Term Sheet at p. 1), DOE proposes to require that building framing cavities not be used as ducts or plenums under § 460.201(a).

Section 460.201(b) would establish procedures for ensuring compliance with the duct system air leakage standard under § 460.201(a). As discussed in this preamble, the MH working group did not address options for systems of compliance and enforcement, and DOE has not included proposed compliance and enforcement provisions in this rule. In the event that DOE addresses compliance assurance in a future rulemaking, paragraph (b) would be reserved to provide a methodology for determining compliance with this standard that would provide for an accurate and repeatable procedure.

The 2015 IECC also includes specifications associated with duct systems that DOE has not included in this proposed rule. Section R403.3.1 of the 2015 IECC specifies that supply ducts in attics shall be insulated to a minimum of *R*-8 while all other ducts shall be insulated to a minimum of *R*-6. The MH working group did not discuss this section of the 2015 IECC. Because ducts are typically located within the building thermal envelope in manufactured homes, DOE did not include this IECC requirement. DOE requests comment on this proposal.

DOE also would not incorporate sections R403.3.2 and R403.3.2.1 of the 2015 IECC, which specify that sealing of ducts, air handlers, and filter boxes must be in accordance with the International Mechanical Code or the International Residential Code. DOE believes that additional sealing requirements are not needed in conjunction with the proposed quantitative sealing requirements in § 460.201(a). DOE recognizes, however, that some manufacturers may choose to meet the requirements of § 460.201(a) in part by voluntarily following the requirements of the International Mechanical Code or the International Residential Code.

(b) § 460.202 Thermostats and Controls

Section R403.1 of the 2015 IECC specifies that at least one thermostat shall be provided for each separate heating and cooling system. Section R403.1.1 of the 2015 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. The 2015 IECC further specifies that where the primary heating system is a forced-air furnace, at least one thermostat per dwelling unit 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. The 2015 IECC also specifies that this thermostat to have the capability of setting back, or

temporarily operating, the system to maintain zone temperatures as low as 55 °F or as high as 85 °F.

DOE has adopted section R403.1 of the 2015 IECC into § 460.202(a) without revision. DOE also has incorporated section R403.1.1 of the 2015 IECC into § 460.202(b). As proposed, § 460.202 would apply to any thermostat and controls installed by the manufacturer. A thermostat is a necessary interface for establishing desired temperature levels within a home, and already standard practice currently. Programmable thermostats help consumers save energy by providing the capability reduce energy use automatically during predetermined times (generally times the home is not occupied). This is also consistent with recommendations of the MH working group. *See* Term Sheet at 1.

Moreover, section R403.1.2 of the 2015 IECC specifies that heat pumps having supplementary electric-resistance heat to have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load. Supplementary electric-resistance heating equipment is less efficient and less cost-effective as a heating method than heat-pump heating equipment. Therefore, preventing supplementary electric-resistance heating except for during defrost would reduce energy usage and manufactured home energy bills. DOE notes that § 3280.714(a)(1)(ii) of the HUD Code establishes requirements for heat pumps. DOE is not aware of any instances in which the proposed requirement, which provides that the heating system be provided with controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load, would conflict with § 3280.714(a)(1)(ii). DOE thus proposes to include this requirement in this rule, as recommended by the MH working group. *See* Term Sheet at 1.

DOE requests comment on the proposed requirements contained in § 460.202. Specifically, DOE requests comment and information on the potential interaction between proposed § 460.202(c) and § 3280.714(a)(1)(ii) of the HUD Code.

(c) § 460.203 Service Hot Water Systems

Section 460.203(a) would require manufacturers to 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.

Section 403.5.1 of the 2015 IECC specifies that automatic controls, temperature sensors, and pumps related to service water heating must be accessible and that manual controls be ''readily accessible.'' § 460.203(b) would require any automatic and manual controls, temperature sensors, pumps associated with service water heating systems to be similarly accessible. This requirement would ensure that manufactured homeowners would have adequate control over service water heating equipment in order to achieve the intended level of efficiency contemplated under part 460. This is also consistent with the recommendation of the MH working group. *See* Term Sheet at 1.

Section 403.5.1.1 of the 2015 IECC specifies that (1) heated water circulation systems be provided with a circulation pump, and the system return pipe be a dedicated return pipe or cold water supply pipe; (2) gravity and thermosyphon circulation systems are prohibited; (3) controls for circulating hot water system pumps must start the pump based on the identification of a demand for hot water within the occupancy; and (4) the controls must 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. Heated water circulation systems must have a circulation pump (if they are not of the gravity or thermosyphon variety) to function properly. Moreover, gravity or thermosyphon circulation systems are less efficient than those that use a pump. Manufactured homeowners would benefit from the energy savings associated with controls used to operate the circulation pump based on demand from a user and that automatically turn off the pump when there is no demand for hot water. Finally, controls that automatically turn off the pump once the desired temperature is reached reduce energy use relative to a system that runs the pump continuously. Accordingly, DOE has incorporated each of these specifications into proposed § 460.203(c) without change to ensure heated water circulation systems are designed in an energy efficient manner.

Section R403.5.2 of the 2015 IECC includes specifications that are related to demand recirculation systems. Conventional hot water systems send cold water (hot water that has cooled) standing in the hot water pipe down the drain when hot water is demanded by the home owner. After the cold water is flushed out, hot water from the water heater reaches the point of use. Demand recirculation systems differ from conventional hot water systems in that any cold water standing in hot water pipes at the time hot water is demanded is sent back to the hot water system rather than being dumped down the drain. Given that these systems, while technically feasible to install in manufactured housing, are not currently in use by the industry, DOE proposes not to include any requirements relating to demand recirculation systems in this proposed rule; however, DOE requests comment on the potential benefits and burdens of including demand recirculation system standards for consideration in development of a final rule.

Section R403.5.4 of the 2015 IECC specifies standards and test procedures for drain water heat recovery units. Given that these devices typically are not used in manufactured homes, DOE proposes not to include any requirements related to drain water heat recovery units in this proposed rule; however, DOE requests comment on the potential benefits and burdens of drain water heat recovery unit procedures for consideration in development of a final rule.

DOE proposes that all hot water pipes outside conditioned space would be required to be insulated to at least *R*-3, and that all hot water pipes from a water heater to a distribution manifold would be required to be insulated to at least *R*-3. Section R403.5.3 of the 2015 IECC specifies seven categories of hot water pipe (such as piping outside the conditioned space) that must be insulated to at least *R*-3. Section 460.203(e) has incorporated each of the categories of piping listed under section R403.5.3 of the 2015 IECC that are relevant to manufactured housing. Accordingly, DOE has not adopted specifications related to piping under a floor slab, buried-in piping, and supply and return piping in recirculation system other than demand recirculation systems. Any piping located within conditioned space is unlikely to affect energy use dramatically, as hot water eventually will reach room temperature regardless of whether *R*-3 insulation is in place. Hot water piping outside of conditioned space is exposed to a larger temperature gradient and therefore

piping insulation would have a greater opportunity for energy conservation within a manufactured home. This is also consistent with the recommendations of the MH working group. *See* Term Sheet at 6.

(d) § 460.204 Mechanical Ventilation Fan Efficacy

Table 403.6.1 of the 2015 IECC includes requirements for mechanical ventilation system fan efficacy. Consistent with the recommendations of the MH working group, and because DOE considers that there would be significant potential energy savings benefits associated with fan efficacy, DOE proposes to incorporate these specifications, without change, into Table 460.204. *See* Term Sheet at 1.

Section 403.6.1 of the 2015 IECC specifies that if mechanical ventilation fans are integral to tested and listed HVAC equipment, then they must be powered with an electronically commutated motor. The MH working group (*see* Term Sheet at 1) recommended that DOE include this requirement in the proposed rule without change. Since electronically commutated motors offer substantially increased energy conservation over conventional induction motors, DOE proposes to include this requirement in the proposed rule.

Section 3280.103(b) of the HUD Code establishes whole-house ventilation requirements, including that a manufactured home must be capable of providing 0.035 cubic feet (air volume) per minute per square foot (floor area) of mechanical ventilation. Section 3280.103(b) also requires that the flow rate of the system must be between 50 and 90 cubic feet per minute. In contrast, § 460.204 would establish requirements for the electrical efficiency of the fans providing the ventilation. These regulations would not conflict, as HUD regulates the ''size'' of the ventilation system while DOE would regulate the efficiency of the fans that provide ventilation.

(e) § 460.205 Equipment Sizing

Section R403.7 of the 2015 IECC sets forth specifications on the appropriate sizing of heating and cooling equipment within a manufactured home, which the MH working group recommended for inclusion in the proposed rule. *See* Term Sheet at 1. This section of the 2015 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 2015 IECC also includes the option to use ''other approved'' calculation methodologies and requires that new or replacement heating and cooling equipment meet minimum energy efficiency requirements as required by federal law. Section 460.205 would set forth specific requirements for the utilization of ACCA Manuals S and Manual J for the purposes of selecting equipment size and calculating building load. The ACCA manuals are industry standards that DOE has determined are adequate for these calculations. DOE has not approved any other calculation methodologies because no other applicable, widely-used methodologies are currently available. DOE requests comment on the applicability of ACCA Manual S and ACCA Manual J for the purposes of heating and cooling equipment sizing.

Section R403.7 of the 2015 IECC also specifies that any replacement heating or cooling equipment be compliant with federal law. DOE would not adopt section R403.7 as there would be no need to remind manufacturers of the requirement to comply with existing federal law.

C. Other 2015 IECC Specifications

The following section discusses certain specifications included in the 2015 IECC that DOE has not included in the development of its proposed energy conservation standards. DOE requests comment with regard to each of these specifications, including whether DOE should incorporate any of the specifications in development of a final rule.

1. Section R302

Section R302 of the 2015 IECC specifies interior design temperatures that are to be used for heating and cooling load calculations when using energy use modeling. Given that the proposed rule does not include an option for compliance with the building thermal envelope requirements that makes use of simulated performance (*see* section R405 of the 2105 IECC), DOE has not included this requirement in the proposed rule. DOE requests comment on the practicality and functionality of using a simulated performance alternative that contemplates the adoption of sections R302 and R405 of the 2015 IECC.

2. Section R303.1

Section R303.1 of the 2015 IECC specifies how materials, systems, and equipment are to be identified. DOE has not incorporated these specifications in the proposed rule as the underlying statutory authority provides no direction for DOE to impose requirements on component manufacturers.

3. Section R401.3

Section R401.3 of the 2015 IECC specifies that a permanent certificate be posted in a utility room that gives the performance values of major building components and systems. Provisions related to enforcement and compliance of the proposed DOE standards were not contemplated by the MH working group and therefore are not included in this proposed rule.

4. Section R402.4

Section R402.4.2 of the 2015 IECC specifies that wood-burning fireplaces shall have tight fitting doors and outdoor combustion air. The IECC also requires that the fireplace and tight fitting doors must be listed and labeled in accordance with certain referenced standards. DOE is proposing not to include these requirements in this rule because they were not specifically addressed by the MH working group.

Section R402.4.5 of the 2015 IECC also specifies that recessed luminaires must be IC-rated. DOE has not adopted section R402.4.5 as fire safety was not contemplated by the MH working group.

5. Section R403

Section R403.2 of the 2015 IECC includes specifications for hot water boiler outdoor temperature setback. Given that hot water boilers used to supply building heat are not used in manufactured homes, DOE has not adopted requirements based on section R403.2 of the 2015 IECC under this proposed rule.

Section R403.5.1.2 of the 2015 IECC includes specifications for electric heat trace systems. The IECC requires that these systems comply with certain referenced standards. DOE is proposing not to include this requirement because electric heat trace systems are not commonly used in manufactured housing.

Section R403.4 of the 2015 IECC specifies a minimum of *R*-3 insulation on mechanical system piping capable of carrying fluids above 105 °F or below 55 °F. Section R403.4.1 of the 2015 IECC specifies that mechanical system piping insulation exposed to weather must be protected to prevent insulation degradation. These specifications are intended to reduce heat loss or gain and improve the energy efficiency of the piping delivery system. Mechanical systems that require piping holding fluids in this temperature range are unusual for manufactured housing. *See* Cavco, EERE–2009–BT–BC–0021–0133 at p. 63. Furthermore, DOE expects that the manufacturer of the mechanical system would require piping insulation

of at least *R*-3 for proper installation. For the aforementioned reasons, DOE is not proposing to include the requirements of section R403.4 and R403.4.1 of the 2015 IECC. DOE requests comment on this proposal.

Section R403.8 of the 2015 IECC includes specifications for systems serving as multiple dwelling units. Consistent with the recommendation of the MH working group (*see* Term Sheet at 1), and because a manufactured home typically functions only as a single dwelling unit, DOE has not adopted requirements related to section R403.8 of the 2015 IECC under this proposed rule.

Section R403.9 of the 2015 IECC includes specifications for pavement snow- and ice-melting controls. Consistent with the recommendation of the MH working group (*see* Term Sheet at 1), and because the factory assembly of manufactured homes does not contemplate driveway conditions, DOE has not adopted requirements related to section R403.9 of the 2015 IECC in this proposed rule.

Sections R403.10, R403.11, and R403.12 of the 2015 IECC include specifications associated with the energy consumption of pools, permanent spas, and portable spas. Consistent with the recommendation of the MH working group (*see* Term Sheet at 1), and because the factory assembly of manufactured homes does not include pools and spas, DOE has not adopted requirements related to these sections of the 2015 IECC in this proposed rule.

6. Section R404

Section R404.1 of the 2015 IECC specifies either that a minimum of 75 percent of the lamps within each permanently installed lighting fixture be high-efficacy lamps or that a minimum of 75 percent of the permanently installed lighting fixtures contain only high-efficacy lamps. The 2015 IECC defines high-efficacy lighting as (1) compact fluorescent lamps; (2) T8 or smaller diameter linear fluorescent lamps; or (3) lamps with a minimum efficacy of 60 lumens per watt for lamps greater than 40 watts, 50 lumens per watt for lamps greater than 15 watts and less than or equal to 40 watts, and 40 lumens per watt for lamps less than or equal to 15 watts. Consumer adoption of high-efficacy lighting has increased over the past decade, as evidenced by section 3.4.5 of the preliminary TSD associated with the DOE general service lamp energy conservation standard. *See* 79 FR 73503 (Dec. 11, 2014). This ongoing rulemaking for general service lamps studies the benefits and burdens of establishing nationwide minimum lamp efficacy standards. DOE also completed a final rule adopting revised lamp efficacy standards for general service fluorescent lamps on January 26, 2015. *See* 80 FR 4041. Given DOE's ongoing efforts in this regard, DOE has not adopted requirements related to lighting in the proposed rule and requests comment on whether DOE's other rulemaking efforts would be insufficient to achieve lighting efficiency in manufactured housing.

Section R404.1.1 of the 2015 IECC includes specifications for fuel gas lighting systems. Given that manufactured homes do not utilize fuel gas lighting systems, DOE has not adopted requirements related to section R404.1.1 of the 2015 IECC in this proposed rule.

7. Section R405

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. Although DOE believes that simulated performance is a valid and technically feasible option, such an option does not appear to offer additional flexibility in the design of a manufactured home relative to the performance-based approach for the building thermal envelope. Accordingly, DOE has not adopted requirements associated with alternative performance under the proposed rule. DOE requests comment on the practicality and functionality of using a simulated performance alternative that contemplates the adoption of sections R302 and R405 of the 2015 IECC.

8. Section R406

Section R406 of the 2015 IECC establishes criteria for compliance using an energy rating index (ERI) that contemplates the use of software to calculate the energy use of a building. Although DOE believes that ERI analysis is a valid and technically feasible option, such an option does not appear to offer additional flexibility in the design of a manufactured home relative to the performance-based approach for the building thermal envelope. Accordingly, DOE has not adopted requirements associated with alternative performance under the proposed rule. DOE requests comment on the practicality and functionality of adopting an ERI alternative that contemplates the adoption of section R406 of the 2015 IECC.

9. Chapter 5

Chapter 5 of the 2015 IECC includes specifications related to the alteration, repair, addition, and change of occupancy of existing buildings and structures. Given that the proposed rule contemplates the energy conservation of newly constructed manufactured homes, DOE has not adopted any of the specifications included in chapter 5 of the 2015 IECC.

10. Chapter 6

Chapter 6 of the 2015 IECC lists the industry standards referenced in the 2015 IECC. Section 460.3 incorporates by reference only the industry standards relevant to the proposals included in this proposed rule, with specific modifications as applicable to manufactured housing. Accordingly, DOE has not adopted the industry standards as referenced in chapter 6 of the 2015 IECC.

D. Crosswalk of Proposed Standards With the HUD Code

As discussed in this preamble, DOE's intention in proposing energy conservation standards for manufactured homes is that, if finalized, there would be no conflict between the proposed requirements and the construction and safety standards for manufactured homes as established by HUD. That is, compliance with the proposed requirements would not prohibit a manufacturer from complying with the HUD Code. Table III.2 lists the proposed energy conservation standards and discusses their relationship to similar requirements contained in the HUD Code. As this proposed approach requires careful analysis of all aspects of energy conservation contained in both the proposed rule and in the HUD Code, DOE requests comment on any inconsistencies that would result from this proposed approach.

TABLE III.2—CROSSWALK OF PROPOSED STANDARDS WITH THE HUD CODE

DOE Proposed rule (10 CFR part 460)	HUD Code (24 CFR part 3280)	Notes
§ 460.101 would establish four climate zones, which would be delineated by home size and both state and county boundaries.	§ 3280.506 establishes three climate zones delineated by state boundaries. The HUD Code establishes one standard for homes of all sizes within a climate zone.	HUD Code climate zone 3 and the northern portion of HUD Code climate zone 2 cover a similar region to climate zones 3 and 4 of the proposed rule. HUD Code climate zones 1 and the southern portion of HUD Code climate zone 2 cover a similar region to climate zones 1, 2, and 3 of the proposed rule.
§ 460.102(a) would establish building thermal envelope prescriptive and performance compliance options.	§ 3280.506 establishes a performance approach.	
§ 460.102(b) would set forth the prescriptive option for compliance with the building thermal envelope requirements.	§ 3280.506 establishes a performance approach only.	
§ 460.102(b)(2) would establish a minimum truss heel height.	No corresponding requirement.	
§ 460.102(b)(3) would require ceiling insulation to have uniform thickness and density.	No corresponding requirement.	
§ 460.102(b)(4) would establish an acceptable batt and blanket insulation combination for compliance with the floor insulation requirement in climate zone 4.	No corresponding requirement.	
§ 460.102(b)(5) would identify certain skylights not subject to SHGC requirements.	No corresponding requirements.	
§ 460.102(b)(6) would establish *U*-factor alternatives for the *R*-value requirements under § 460.102(b)(1).	No corresponding requirements.	
§ 460.102(b)(7) would establish a maximum ratio of 12 percent for glazed fenestration area to floor area under the prescriptive option.	No corresponding requirements.	
§ 460.102(c)(1) would establish maximum building thermal envelope U_o requirements by home size and climate zone.	§ 3280.506(a) establishes maximum building thermal envelope U_o requirements by climate zone.	The proposed maximum building thermal envelope U_o requirements would be lower than the corresponding maximum U_o requirements under § 3280.506(a). Compliance with the proposed U_o requirements would achieve compliance with the U_o requirements under the HUD Code.
§ 460.102(c)(2) would establish maximum area-weighted vertical fenestration *U*-factor requirements in climate zones 3 and 4.	No corresponding requirements.	
§ 460.102(c)(3) would establish maximum area-weighted average skylight *U*-factor requirements in climate zones 3 and 4.	No corresponding requirements.	
§ 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.	
§ 460.102(d)(1)		[Reserved].
§ 460.102(d)(2)		[Reserved].
§ 460.102(d)(3) would establish a method of determining total *R*-value where multiple layers comprise a component.	§ 3280.508(a) and (b) reference the Overall *U*-values and Heating/Cooling Loads—Manufactured Homes method and the 1997 ASHRAE Handbook of Fundamentals.	
§ 460.102(d)(4)		[Reserved].
§ 460.102(d)(5)		[Reserved].
§ 460.102(d)(6) would establish prescriptive default *U*-factor values.	§ 3280.508(a) and (b) reference the Overall *U*-values and Heating/Cooling Loads—Manufactured Homes method and the 1997 ASHRAE Handbook of Fundamentals.	
§ 460.102(d)(7)		[Reserved].
§ 460.102(d)(8) would establish prescriptive default *U*-factor values.	No corresponding requirements.	
§ 460.102(e)(1) would establish a method of determining U_o.	§ 3280.508(a) and (b) reference the Overall *U*-values and Heating/Cooling Loads—Manufactured Homes method and the 1997 ASHRAE Handbook of Fundamentals.	
§ 460.102(e)(2)		[Reserved].

TABLE III.2—CROSSWALK OF PROPOSED STANDARDS WITH THE HUD CODE—Continued

DOE Proposed rule (10 CFR part 460)	HUD Code (24 CFR part 3280)	Notes
§ 460.102(e)(3) would establish default fenestration and door *U*-factor and fenestration SHGC values.	§ 3280.508(a) and (b) reference the Overall *U*-values and Heating/Cooling Loads—Manufactured Homes method and the 1997 ASHRAE Handbook of Fundamentals. These references contain default values.	DOE's proposed default values originate from the 2015 IECC. These default values generally result in lower performance than the HUD Code values. DOE expects compliance with the proposed rule to result in compliance with the HUD Code.
§ 460.103(a) would require insulating materials to be installed according to the manufacturer installation instructions and the prescriptive requirements of Table 460.103.	No corresponding requirements.	
§ 460.103(b) would establish requirements for the installation of batt, blanket, loose fill, and sprayed insulation materials.	No corresponding requirements.	
§ 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.	§ 3280.505 establishes air sealing requirements of building thermal envelope penetrations and joints.	
§ 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 when tested according to § 460.201(b) and specifies that building framing cavities are not to be used as ducts or plenums.	§ 3280.715(a)(4) establishes requirements for airtightness of supply duct systems.	
§ 460.201(b)	.....	[Reserved].
§ 460.202(a) would require at least one thermostat to be provided for each separate heating and cooling system installed by the manufacturer.	§ 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 the proposed rule and the HUD Code would require the installation of at least one thermostat that is capable of maintaining zone temperatures.
§ 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.	No corresponding requirements.	
§ 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.	§ 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 the proposed rule and the HUD Code would 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.
§ 460.203(a) would establish requirements for the installation of service water heating systems.	No corresponding requirements.	
§ 460.203(b) would require any automatic and manual controls, temperature sensors, pumps associated with service water heating systems to be accessible.	No corresponding requirement.	
§ 460.203(c) would establish requirements for heated water circulation systems.	No corresponding requirements.	
§ 460.203(d) would establish requirement for the insulation of hot water pipes.	No corresponding requirements.	
§ 460.204 would establish requirements for mechanical ventilation system fan efficacy.	No corresponding requirements	HUD requirements at § 3280.103(b) do not overlap with DOE's proposal. DOE's proposal is for fan electrical efficiency, while HUD requirements specify minimum and maximum air flow rates.
§ 460.205 would establish requirements for heating and cooling equipment sizing.	No corresponding requirements.	

E. Compliance and Enforcement

Although DOE is not considering compliance and enforcement in this proposed rule, DOE anticipates assessing compliance and enforcement mechanisms in a future rulemaking. As a result, the costs and benefits resulting from any compliance and enforcement mechanism are not included in the economic impact analysis that is included in this rulemaking. DOE anticipates it will provide a detailed analysis of the costs and benefits resulting from compliance and enforcement activities in its future rulemaking. A variety of possibilities may be considered in that rulemaking process including, but not limited to, the three options described in this paragraph. First, HUD could directly administer a compliance and enforcement program for DOE's manufactured housing regulations via the existing HUD system outlined at 24 CFR 3282. This option would require that HUD adopt the energy conservation standards resulting from this rulemaking into its Manufactured Home Construction and Safety Standards. Second, DOE could implement a compliance and enforcement program mirroring HUD's system codified at 24 CFR 3282. Third, manufacturers could self-certify compliance to DOE by submitting documentation attesting that manufactured homes are compliant with DOE regulations. This third compliance option could be paired with a variety of enforcement mechanisms ranging from unannounced inspections and audits to a system mirroring HUD's enforcement system at 24 CFR 3282.

By way of background, under HUD's compliance and enforcement system, manufacturers are required to: (1) Contract for services with a HUD accepted Design Approval Primary Inspection Agency (DAPIA) to evaluate their designs and quality assurance manual for conformance with the Standards and Regulations; and (2) contract for services with a HUD accepted Production Inspection Primary Inspection Agency (IPIA) to evaluate, through on-going surveillance of the production process, that each plant is continuing to follow its DAPIA approved quality assurance manual and quality control procedures and to verify that each factory is continuing to produce homes in conformance with the Standards. In addition, the actions of all primary inspection agencies (DAPIAs, IPIAs) and State Administrative Agencies (SAAs) are monitored to determine whether they are fulfilling their responsibilities under HUD's regulatory system. In addition, manufacturers are also subject to system of notification and correction procedures whenever they produce homes that contain imminent safety hazards or failures to conform to the HUD standards.

DOE seeks comment on potential options for compliance and enforcement to be considered in a future rulemaking, including information regarding the rationale for any recommended option. DOE also seeks comment on the estimated costs (only direct compliance and enforcement costs, not engineering costs for redesign) and time (design review validation, inspection frequency and duration, administrative procedures) associated with the potential options.

IV. Economic Impacts and Energy Savings

A. Economic Impacts on Individual Purchasers of Manufactured Homes

DOE used the LCC and payback period (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, consisting of purchase expenses (*i.e.,* mortgage or cash purchase) and operating costs (*i.e.,* 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. The PBP refers to the estimated amount of time (in years) for manufactured homeowners to recover the increased purchase cost (including installation) of their homes through lower operating costs. DOE calculates the PBP by dividing the incremental increase in purchase cost by the reduction in average annual operating costs that would result from this proposed rule.

The LCC analysis demonstrates that increased purchase prices would be offset by the benefits manufactured homeowners would experience in operating cost savings under the proposed rule. DOE has evaluated these projected impacts on individual manufactured homeowners by analyzing the potential impacts to LCC, energy savings, and purchase price of manufactured homes under the proposed rule. For the purpose of this 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 [6] manufactured homes). Further information on how DOE calculated LCC impacts and energy savings for the alternative efficiency levels discussed here is included in chapter 8 of the TSD. DOE requests comment on the methodology and results of the LCC analysis.

Table IV.1 provides the preliminary average purchase price increases to manufactured homes associated with the proposed rule under each of the proposed climate zones. These costs are based on estimates for the increased costs associated with more energy efficient components, as provided by the MH working group. *See* EERE–2009–BT–BC–0021–0091. These costs are discussed in further detail in chapter 5 and chapter 9 of the TSD.

TABLE IV.1—AVERAGE MANUFACTURED HOME PURCHASE PRICE AND PERCENTAGE INCREASES UNDER THE PROPOSED RULE BY CLIMATE ZONE

	Single-section		Multi-section	
	$	%	$	%
Climate Zone 1	2,422	5.3	3,748	4.5
Climate Zone 2	2,348	5.1	3,668	4.4

[6] 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.

TABLE IV.1—AVERAGE MANUFACTURED HOME PURCHASE PRICE AND PERCENTAGE INCREASES UNDER THE PROPOSED RULE BY CLIMATE ZONE—Continued

	Single-section		Multi-section	
	$	%	$	%
Climate Zone 3	2,041	4.5	2,655	3.2
Climate Zone 4	2,208	4.8	2,877	3.4
National Average	2,226	4.9	3,109	3.7

Although DOE preliminarily has determined that the proposed standards would result in increased purchase prices of manufactured homes, manufactured homeowners, on average, would realize significant LCC savings and energy savings as a result of the proposed rule. DOE requests comment on affordability with respect to the projected average increase in purchase cost (see Table IV.1 below) on the ability of low-income consumers to obtain credit and financing to purchase a manufactured home. DOE also requests comments on affordability in context of the potential for reduced operating costs (energy bills) and total LCC.

Figure IV.1 illustrates the average annual energy cost savings for space heating and air conditioning for the first year of occupation by geographic location under the proposed rule based on the estimated fuel costs provided in chapter 8 of the TSD. Heating cost savings are generally higher than cooling cost savings, so locations with cold climates would have higher amounts of energy cost savings because of the reduced heating energy use.

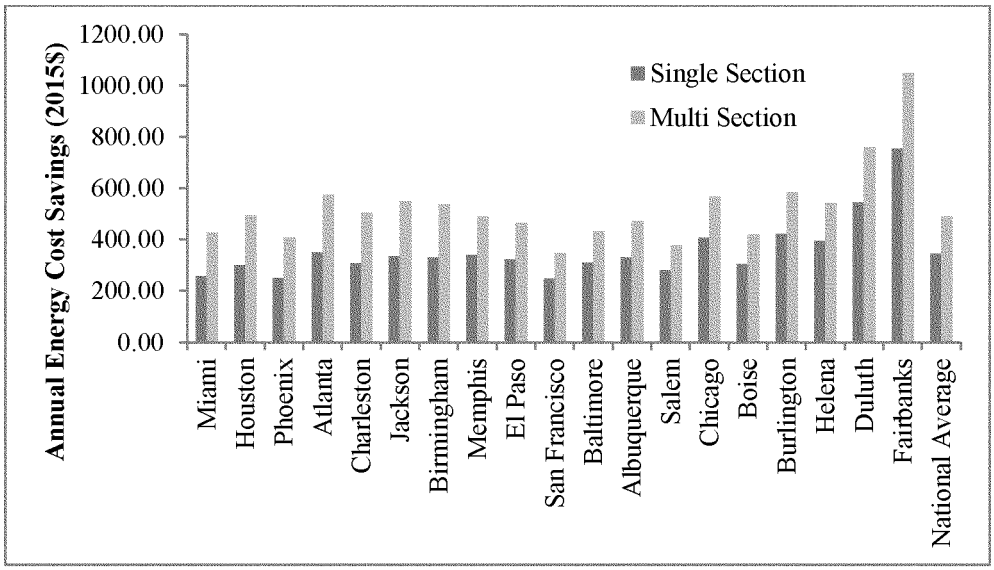


Figure IV.1. Annual Energy Cost Savings under the Proposed Rule

Figure IV.2 illustrates the average 30-year LCC savings by geographic location (averaged across the five different heating fuel/system types) associated with the proposed rule for both single-section and multi-section manufactured homes. As discussed in detail in chapter 9 of the TSD, Figure IV.2 accounts for LCC savings and impacts over a 30-year period of analysis, including energy cost savings and mortgage payment increases discounted to a present value using the discount rates discussed in chapter 4 of the TSD. These preliminary results also are based on the costs associated with energy conservation improvements, as discussed in chapter 5 of the TSD.

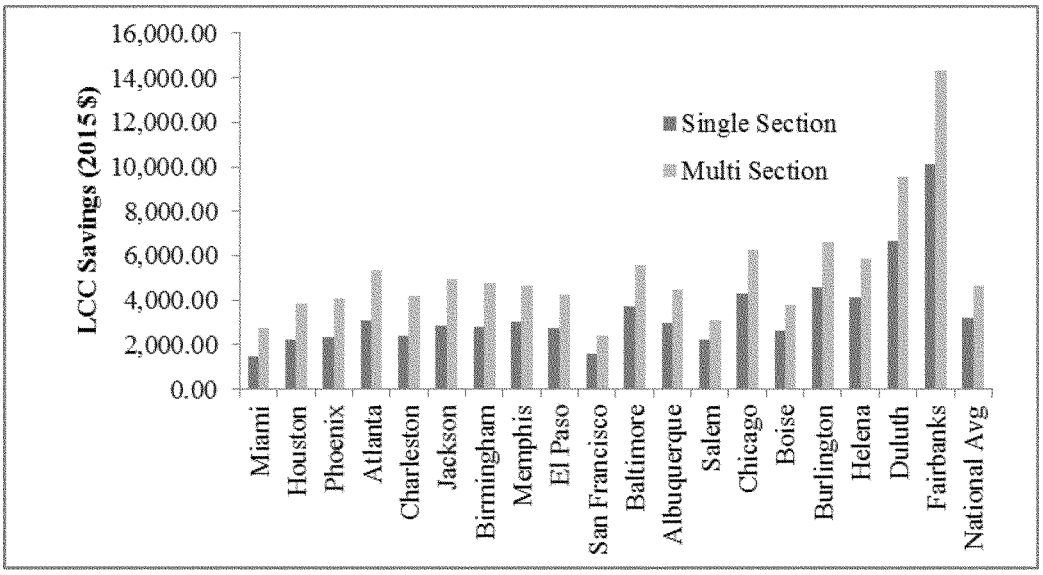


Figure IV.2. Thirty-Year Lifecycle Cost Savings under the Proposed Rule

The estimated LCC impacts under Figure IV.2 vary by location for three primary reasons. First, each geographic location analyzed is situated in one of four proposed 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. For example, both El Paso and Baltimore would be situated in climate zone 3. However, a manufactured home in Baltimore that meets the proposed climate zone 3 requirements would experience greater savings than a manufactured home in El Paso that meets the proposed climate zone 3 requirements because cooler climates would have greater energy cost savings as a result of greater reductions in heating costs. 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 TSD, DOE has accounted for regional differences in heating systems and fuel types commonly installed in manufactured housing.

Table IV.2 provides the preliminary national average LCC savings under the proposed rule and annual energy cost savings associated with the proposed rule 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 TSD, each geographic location preliminary has been determined to result in LCC savings and energy savings, on average.

TABLE IV.2—NATIONAL AVERAGE PER-HOME SAVINGS UNDER THE PROPOSED RULE

	Single-section	Multi-section
Lifecycle Cost Savings (30 Years)	$3,211	$4,625
Annual Energy Cost Savings	345	490

Table IV.3 shows the benefits and costs to the manufactured homeowner associated with the proposed rule, expressed in terms of annualized values.

TABLE IV.3—ANNUALIZED BENEFITS AND COSTS TO MANUFACTURED HOMEOWNERS UNDER THE PROPOSED RULE

	Discount Rate (%)	Monetized (million 2015$/year)		
		Primary estimate **	Low estimate **	High estimate **
Benefits *				
Operating (Energy) Cost Savings	7	516	400	688
	3	843	617	1,191
Costs *				
Incremental Purchase Price Increase	7	220	165	285
	3	277	192	378
Net Benefits/Costs *				
	7	296	235	403
	3	566	425	813

* The benefits and costs are calculated for homes shipped in 2017–2046.
** The Primary, Low, and High Estimates utilize forecasts of energy prices from the 2015 AEO Reference case, Low Economic Growth case, and High Economic Growth case, respectively.

Figure IV.3 illustrates the nationwide average simple payback period (purchase price increase divided by first year energy cost savings) under the proposed rule. The estimated simple payback periods under Figure IV.3 vary by geographic location based on the different climate zone requirements for manufactured housing, geographic climatic differences within climate zones, and the type of heating system installed and fuel type used in a manufactured home.

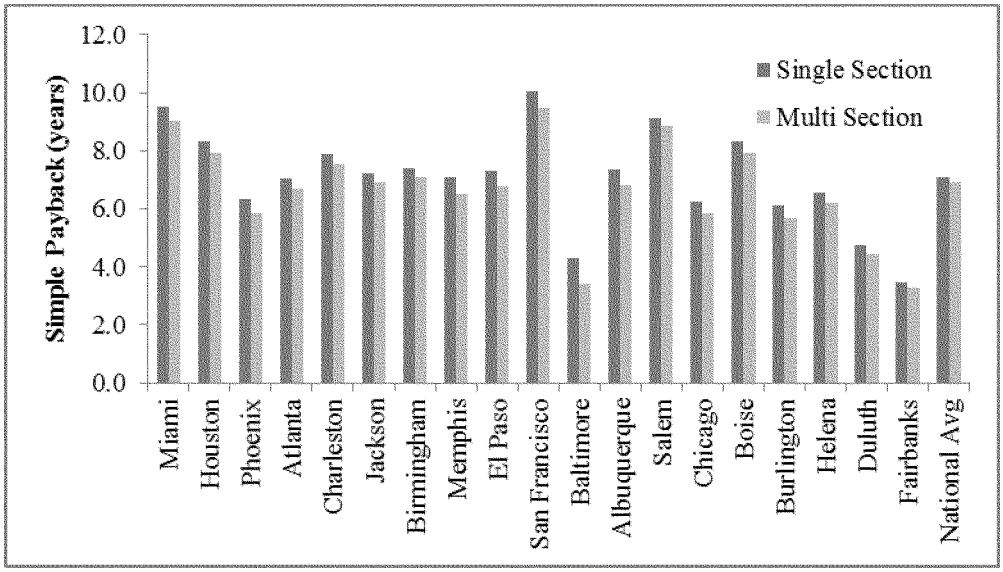


Figure IV.3. Simple Payback Period of the Proposed Rule

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 data on: Industry financial metrics, manufacturer production cost estimates, shipments forecasts, conversion expenditures estimates, and assumptions about 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 (2016–2046), discounted using the industry weighted average cost of capital. The GRIM has a slightly different analysis period than the NIA and LCC because it takes into account the conversion period, the time between the announcement of the standard and the effective date of the standard, since manufacturers may need to make upfront investments to bring their covered products 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 and domestic manufacturing employment between a base case and the standards case. To capture the uncertainty relating to manufacturer pricing strategy following new standards, the GRIM estimates a range of possible impacts under different markup scenarios. Each of the inputs and output is discussed in chapter 12 of the NOPR TSD. DOE used the GRIM to calculate cash flows using standard accounting principles and to compare changes in INPV between a base case and a standards case. The percent change in INPV between the base and standards cases represents the financial impact of new energy conservation standards on manufacturers of manufactured homes. Additional detail on the GRIM can be found in Appendix 12A.

DOE conducted the MIA analysis in three phases. In Phase 1 of the MIA, DOE analyzed the upfront investments, conversation costs, manufacturers would need to make to bring their products into compliance with the new energy conservation standards. These upfront investments include product conversion costs and capital conversion costs. Product conversion costs are one-time investments in research, development, labeling updates, 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 calculated that the proposed rule would result in an average upfront investment, or conversion cost, of $37,500 per manufacturer. This figure includes $32,500 per manufacturer for product conversion costs and $5,000 per manufacturer for capital conversion costs. DOE assumed in its analysis that manufacturers would incur all upfront costs in the year following publication of the final rule. Additional detail on the conversion costs can be found in chapter 12 of the TSD.

In Phase 2 of the MIA, DOE analyzed the effect the proposed standards would have on manufacturer production costs. To be conservative in its analysis, DOE assumed that all units sold are at the HUD minimum. Thus, the analysis does not account for the reduced impact on units sold that may exceed the HUD minimum. Based on this analysis, DOE estimates average manufacturer production costs would increase by $1,321 for each single-section unit and by $1,840 for each multi-section unit. The estimated increases in manufacturer production costs are derived from the estimated increases in purchase price,

the retail markup and the manufacturer markup on these units. As a starting point, DOE used the retail prices of manufactured homes in 19 cities that include all four proposed climate zones. The retail prices were for the base case in each city and the standard case in each city. Using public sources of information, including company SEC 10–K filings [7] and corporate annual reports, DOE applied a consistent manufacturer markup of 1.25 and a retail markup of 1.30 for the base cases and standards cases. DOE used these two markups, and along with a sales tax multiplier, to back-calculate the manufacturer production cost for each city. Details on the derivation of the sales tax multiplier, retail markup, manufacturer markup, and manufacturer production cost for each city can be found in chapter 12 of the NOPR TSD. DOE requests comments on whether other manufacturer and retailer markups for base case and standards cases should be considered (*e.g.,* a combined mark-up of 2.30 has historically been used in the past by HUD to assess combined manufacturer and retailer mark-ups to determine potential first cost impacts on consumers).

In Phase 3 of the MIA, DOE modeled two scenarios that reflect changes in the manufacturer's ability to pass on their upfront investments and increases in production costs to the customers. As manufacturer production costs increase, manufacturers may need to adjust their markup structure. For the MIA, DOE modeled two standards case markup scenarios for manufactured homes to represent the uncertainty regarding the potential impacts on prices and profitability for manufactured home manufacturers following the implementation of the proposed rule. DOE modeled a high and a low scenario for a manufacturer to pass on their upfront investments and increases in production costs to the customer: (1) A preservation of gross margin percentage markup scenario; and (2) a preservation of operating profit markup scenario. These scenarios lead to different markup values that, when applied to the inputted manufacturer production costs, result in varying revenue and cash flow impacts on the manufacturer.

Under the preservation of gross margin percentage markup scenario, manufacturers maintain their current average markup of 1.25 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 pass on the costs of compliance to their customers. 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 operating profit one year after the compliance date of the amended energy conservation standard is the same as in the base case on a per unit basis. Under this scenario, as the costs of production increase under a standards case, manufacturers are generally required to reduce their markups. The implicit assumption behind this markup scenario is that the industry can only maintain its operating profit in absolute dollars per unit after compliance with the new standard is required. Therefore, operating margin is reduced between the base case and standards case. This markup scenario represents a lower bound to industry profitability under an amended energy conservation standard.

DOE calculated an industry average discount rate of 9.2% based on SEC filings for public manufacturers of manufactured homes. This discount rate was used to estimate the time-value of money when discounting future cash flows. The INPV is the sum of the discounted cash flows over the analysis period, which begins in 2016 and ends in 2046. When applying the two different markup scenarios, DOE is able to estimate a range of potential impacts to INPV and the industry. DOE compares the INPV of the base case to that of the proposed level. The difference between INPV in the base case and INPV at the proposed level is an estimate of the economic impacts on the industry.

TABLE IV.4—INPV RESULTS: PRESERVATION OF GROSS MARGIN PERCENTAGE SCENARIO *

	Single-section	Multi-section	Total industry
Base Case INPV (million 2015$)	229.0	487.8	716.7
Standards Case INPV (million 2015$)	227.9	485.8	713.6
Change in INPV (million 2015$)	(1.1)	(2.0)	(3.1)
Change in INPV (%)	−0.5%	−0.4%	−0.4%
Total Conversion Costs (million 2015$)	0.5	1.1	1.6

* Values in parentheses are negative values.

TABLE IV.5—INPV RESULTS: PRESERVATION OF OPERATING PROFIT MARKUP SCENARIO *

	Single-section	Multi-section	Total industry
Base Case INPV (million 2015$)	229.0	487.8	716.7
Standards Case INPV (million 2015$)	215.0	465.0	680.0
Change in INPV (million 2015$)	(14.0)	(22.8)	(36.8)
Change in INPV (%)	−6.1%	−4.7%	−5.1%
Total Conversion Costs (million 2015$)	0.5	1.1	1.6

* Values in parentheses are negative values.

For single-section units, the base case INPV is $229.0 million. The proposed standard could result in a drop of industry value ranging from −0.5 percent to −6.1 percent, or a loss of $1.1 million to $14.0 million. For multi-section units, the base case INPV is $487.8 million. The proposed standard could result in a drop of industry value

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

ranging from −0.4 percent to −4.7 percent, or a loss of $2.0 million to $22.8 million. For the industry as a whole, the base case INPV is $716.7 million. The proposed standard could result in a drop in INPV of −0.4 percent to −5.1 percent, or a loss of $3.1 million to $36.8 million. Industry conversion costs total $1.6 million at the proposed level.

Though DOE's analysis assumes all manufactured homes are sold at the HUD minimum level (analyzed as the baseline in this rulemaking), select manufactured homes are available in the market at higher efficiencies. If a manufacturer currently produces homes that are more efficient than the HUD minimum level, the impacts associated with that manufacturer will be reduced. For example, the incremental manufacturer production cost would be smaller for a manufacturer already producing homes above the minimum level. If a manufacturer already produces homes compliant with the proposed level, then the manufacturer would experience no conversion costs or increases in production costs for those models.

DOE requests comment on the conversion costs for proposed standard. DOE welcomes additional data regarding the cost to redesign model plans to meet the proposed standard and the capital expenditures that the proposed standard would require.

DOE also requests comment on the average manufacturer markup for single-section and multi-section homes, including any differences in markup between minimally compliant homes and homes with upgrades that improve energy performance. Additionally, DOE requests comment on the average retail markup in the industry.

C. Nationwide Impacts

DOE's NIA projects 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 customer 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) described in section IV.A of this **SUPPLEMENTARY INFORMATION** and shipment projections. DOE projected the energy savings, operating cost savings, equipment costs, and NPV of customer benefits sold in a 30-year period from 2017 through 2046. The analysis also accounts for costs and savings for a manufactured home lifetime of 30 years. A detailed description of the NIA methodology is provided in chapter 11 of the TSD. DOE requests comment on the methodology and initial findings of the NIA.

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.[8] 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 base 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 shipment) based on a study published in the *Journal of Housing Economics*[9] for estimating standards case shipments.

In a second sensitivity analysis, DOE also 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 proposed rule. 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 as forecasted in the proposed rule.

A detailed description of the shipments methodology is provided in chapter 10 of the TSD. DOE requests comment on the methodology and initial findings of the shipments analysis.

Table IV.6 and Table IV.7 reflect the NES results over a 30-year analysis period under the proposed rule 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.6—CUMULATIVE NATIONAL ENERGY SAVINGS OF MANUFACTURED HOMES PURCHASED 2017–2046 WITH A 30-YEAR LIFETIME

	Single-section (quads)	Multi-section (quads)
Climate Zone 1	0.171	0.281
Climate Zone 2	0.124	0.234
Climate Zone 3	0.259	0.449
Climate Zone 4	0.279	0.382
Total	0.833	1.346

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

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

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

TABLE IV.7—CUMULATIVE NATIONAL ENERGY SAVINGS OF MANUFACTURED HOMES PURCHASED 2017–2046 WITH A 30-YEAR LIFETIME

	Single-section (%)	Multi-section (%)
Climate Zone 1	25.3	29.9
Climate Zone 2	25.4	30.6
Climate Zone 3	26.0	28.1
Climate Zone 4	25.4	26.5
Total	25.6	28.4

Table IV.8 and Table IV.9 illustrate the cumulative NES over the 30-year analysis period under the proposed rule on a 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 amongst the different climate zones because of differing energy efficiency requirements in each climate zone and different shipment projections in each climate zone.

TABLE IV.8—CUMULATIVE NATIONAL ENERGY SAVINGS, INCLUDING FULL-FUEL-CYCLE OF MANUFACTURED HOMES PURCHASED 2017–2046 WITH A 30-YEAR LIFETIME

	Single-section (quads)	Multi-section (quads)
Climate Zone 1	0.179	0.294
Climate Zone 2	0.130	0.245
Climate Zone 3	0.272	0.474
Climate Zone 4	0.303	0.416
Total	0.884	1.428

TABLE IV.9—CUMULATIVE NATIONAL ENERGY SAVINGS, INCLUDING FULL-FUEL-CYCLE OF MANUFACTURED HOMES PURCHASED 2017–2046 WITH A 30-YEAR LIFETIME

	Single-section (%)	Multi-section (%)
Climate Zone 1	25.3	29.9
Climate Zone 2	25.4	30.6
Climate Zone 3	26.0	28.1
Climate Zone 4	25.4	26.6
Total	25.6	28.3

Table IV.10 and Table IV.11 illustrate the NPV of customer benefits over the 30-year analysis period under the proposed rule 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 up-front costs and operating cost savings associated with each climate zone and different shipment projections in each climate zone. All climate zones have a positive NPV for both discount rates under this proposed rule.

TABLE IV.10—NET PRESENT VALUE OF MANUFACTURED HOMES PURCHASED 2017–2046 WITH A 30-YEAR LIFETIME AT A 7% DISCOUNT RATE

	Single-section (billion 2015$)	Multi-section (billion 2015$)
Climate Zone 1	0.19	0.34
Climate Zone 2	0.16	0.35
Climate Zone 3	0.39	0.74
Climate Zone 4	0.52	0.74
Total	1.26	2.18

TABLE IV.11—NET PRESENT VALUE OF MANUFACTURED HOMES PURCHASED 2017–2046 WITH A 30-YEAR LIFETIME AT A 3% DISCOUNT RATE

	Single-section (billion 2015$)	Multi-section (billion 2015$)
Climate Zone 1	0.66	1.16
Climate Zone 2	0.54	1.10
Climate Zone 3	1.22	2.26
Climate Zone 4	1.60	2.24
Total	4.03	6.75

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 1.8 percent) based on the trend in actual manufactured home shipments from 2011 to 2014. This growth rate applies to both the base case and standards case shipments. DOE's primary scenario is based on the residential housing start data from *AEO 2015.* The sensitivity analysis calculates the increase in NES and NPV associated with a much larger future market for manufactured homes. See Table IV.12 for results of the sensitivity analysis. A detailed description of the sensitivity analysis is provided in appendix 11A of the TSD. DOE requests comment on the shipment growth rate assumption used in the shipments analysis.

TABLE IV.12—SHIPMENTS GROWTH RATE SENSITIVITY ANALYSIS NES AND NPV RESULTS

	National energy savings (full fuel cycle quads)	Net present value 3% discount rate (billion 2015$)	Net present value 7% discount rate (billion 2015$)
1.8% Shipment Growth (primary scenario)	2.3	10.93	3.47
6.5% Shipment Growth	5.8	26.19	7.38

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 analysis of revisions to its regulations [10] promulgated at 24 CFR 3282 based on a 1992 paper written by Carol Meeks.[11] 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. Price elasticity of −2.4 would translate to a 12 percent reduction in shipments based on a 5 percent increase in price as projected by the proposed rule. Price elasticity of −0.48 would project a 2.4 percent reduction in shipments based on the projected cost increases in this proposed rule. See Table IV.13 for results of the sensitivity analysis. A detailed description of the sensitivity analysis is provided in appendix 11A of the TSD. DOE requests comment on the price elasticity assumption used in the standards case shipments analysis.

TABLE IV.13—PRICE ELASTICITY OF DEMAND SENSITIVITY ANALYSIS NES AND NPV RESULTS

	National energy savings (full fuel cycle quads)	Net present value 3% discount rate (billion 2015$)	Net present value 7% discount rate (billion 2015$)
−0.48 Price Elasticity (primary scenario)	2.3	10.93	3.47
−2.4 Price Elasticity	2.1	10.04	3.19

D. Nationwide Environmental Benefits

DOE's analyses indicate that this proposed rule would reduce overall demand for energy in manufactured housing. The proposed rule 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 would be directly proportional to energy savings that would be achieved. DOE has based 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 estimated reductions in emissions associated with the production of these fuels (extracting, processing, transporting to power plants or homes). Such reductions are referred to as

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

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

''upstream'' emissions reductions. Together, site emissions reductions and upstream emissions reductions account for the FFC. In accordance with DOE's FFC Statement of Policy (*see* 76 FR 51282 (Aug. 18, 2011), 77 FR 49701 (Aug. 17, 2012)), the FFC analysis includes impacts on emissions of CH_4 and N_2O, both of which are recognized as greenhouse gases (GHGs).

The emissions reduction estimates are based on emission intensity factors for each pollutant, which depend on the type of fuel associated with energy savings (electricity, natural gas, liquefied petroleum gas, fuel oil). These emission intensity factors were derived from data in the *AEO 2015* [12] and from the EPA GHG Emissions Factors Hub.[13] Full details of this methodology are described in chapter 13 of the TSD. Table IV.14 reflects the emissions reductions for both single-section and multi-section manufactured homes. DOE requests comment on the methodology and initial findings of the emissions analysis.

TABLE IV.14—EMISSIONS REDUCTIONS AS A RESULT OF THE PROPOSED RULE

Pollutant	Single-section	Multi-section
Site Emissions Reductions		
CO_2 (million metric tons)	56.5	91.1
Hg (metric tons)	0.0904	0.146
NO_X (thousand metric tons)	223	356
SO_2 (thousand metric tons)	27.6	44.4
CH_4 (thousand metric tons)	3.78	6.09
N_2O (thousand metric tons)	0.632	1.02
Upstream Emissions Reductions		
CO_2 (million metric tons)	4.01	6.45
Hg (metric tons)	0.000944	0.00153
NO_X (thousand metric tons)	51.8	83.2
SO_2 (thousand metric tons)	0.615	0.991
CH_4 (thousand metric tons)	239	385
N_2O (thousand metric tons)	0.0294	0.0474
Total Emissions Reductions		
CO_2 (million metric tons)	60.5	97.6
Hg (metric tons)	0.0913	0.148
NO_X (thousand metric tons)	275	439
SO_2 (thousand metric tons)	28.2	45.4
CH_4 (thousand metric tons)	243	391
N_2O (thousand metric tons)	0.661	1.07

Additionally, DOE considered the estimated monetary benefits likely to result from the reduced emissions of CO_2 and NO_X that would be expected to result from the proposed rule. In order to make this calculation similar to the calculation of the net present value of consumer benefit, DOE considered the reduced emissions expected to result over the lifetime of products shipped in the analysis period (2017–2046) under the proposed rule. DOE has calculated the monetary values for each of these emissions using the social cost of carbon (SCC) methodology, which estimates the monetized damages associated with an incremental increase in carbon emissions within a given year. The SCC is intended to account for, but is not limited to, changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services. SCC estimates are given in terms of dollars per metric ton of CO_2 emitted.

The SCC is comprised of monetization estimate results from three different integrated assessment models, which have different methodologies for calculating the damages associated with CO_2 emissions. The SCC values used for this rulemaking were generated using the most recent versions of the three integrated assessment models that have been published in peer-reviewed literature.[14] As a result, four SCC estimates of emitted CO_2 value are available, representing different aggregation of these three models and utilization of a variety of discount rates. Three sets of the monetization factors utilize the average impacts projected by the three assessment models that comprise the SCC. The fourth set of monetization factors utilizes the 95th percentile impacts of the three assessment models and is intended to capture higher than expected impacts. For the purposes of capturing the uncertainty of emitted CO_2 value, the interagency group recommends including all four sets of available SCC values. Full details of this methodology are described in chapter 14 of the TSD. These estimates have been developed by an interagency process and are presented with an acknowledgement of uncertainty. These results should be treated as revisable, as the estimates of emitted CO_2 monetary value evolve with improved scientific and economic understanding.

DOE also has estimated monetary benefits for NO_X emissions under the proposed rule. Estimates of the monetary value of reducing NO_X from stationary sources range 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 is evaluating appropriate monetization of avoided SO_2 and Hg emissions in energy conservation standards rulemakings and has not included such monetization in the current analysis. DOE has similarly not included monetization of reductions in emissions of CH_4 or N_2O. DOE requests comments on the methodology and results of the monetization of emissions reductions benefits analysis. Table IV.15 provides the NPVs from the savings of reduced CO_2 and NO_X emissions resulting from manufactured homes built in accordance with the proposed rule.

[12] *See* Energy Information Administration, *Annual Energy Outlook 2015 with Projections to 2040* (2015), available at *http://www.eia.gov/forecasts/aeo/pdf/0383(2015).pdf.*

[13] *See* U.S. Environmental Protection Agency, *Emissions Factors for Greenhouse Gas Inventories* (2014), available at *http://www.epa.gov/climateleadership/documents/emission-factors.pdf.*

[14] *See* Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866, Interagency Working Group on Social Cost of Carbon, United States Government. May 2013; (revised November 2013), *available at www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf.*

TABLE IV.15—NET PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS UNDER THE PROPOSED RULE

	Discount rate (%)	Net present value (million 2015$)	
		Single-section	Multi-section
Monetary Benefits			
CO_2, Average SCC Case	5	368.2	593.7
CO_2, Average SCC Case	3	1,810.9	2,920.5
CO_2, Average SCC Case	2.5	2,925.0	4,717.3
CO_2, 95th Percentile SCC Case	3	5,581.5	9,001.5
NO_X Reduction	3	311.5	498.6
	7	119.8	191.9

E. Total Benefits and Costs

As explained in greater detail in section IV of this **SUPPLEMENTARY INFORMATION** and in chapter 15 of the TSD, Table IV.16 reflects the total benefits and costs (from the manufactured homeowner's perspective) associated with the proposed rule, expressed in terms of annualized values.[15]

TABLE IV.16—TOTAL ANNUALIZED BENEFITS AND COSTS TO MANUFACTURED HOMEOWNERS UNDER THE PROPOSED RULE

	Monetized (million 2015$/year)			
	Discount rate (%)	Primary estimate **	Low estimate **	High estimate **
Benefits *				
Operating (Energy) Cost Savings	7	516	400	688.
	3	843	617	1,191.
CO_2, Average SCC Case ***	5	63	46	85.
CO_2, Average SCC Case ***	3	241	176	331.
CO_2, Average SCC Case ***	2.5	365	266	503.
CO_2, 95th Percentile SCC Case ***	3	744	543	1,022.
NO_X Reduction at $2,773/metric ton ***	7	25	20	32.
	3	41	31	56.
Total (Operating Cost Savings, CO_2 Reduction and NO_X Reduction).	7 plus CO_2 range	604 to 1,285	466 to 962	805 to 1,742.
	7	783	596	1,052.
		1,126	824	1,578.
	2	947 to 1,628	694 to 1,191	1,332 to 2,269.
	3 plus CO_2 range.			
Costs *				
Incremental Purchase Price Increase	7	220	165	285.
	3	277	192	378.
Net Benefits/Costs *				
Total (Operating Cost Savings, CO_2 Reduction and NO_X Reduction, Minus Incremental Cost Increase to Homes).	7 plus CO_2 range	384 to 1,065	301 to 797	520 to 1,457.
	7	563	431	767.
		849	632	1,200.
	3	670 to 1,351	502 to 999	954 to 1,891.
	3 plus CO_2 range.			

* The benefits and costs are calculated for homes shipped 2017–2046.

** The Primary, Low, and High Estimates utilize forecasts of energy prices from the 2015_AEO Reference case, Low Economic Growth case, and High Economic Growth case, respectively.

*** The CO_2 values represent global monetized values (in 2015$) of the social cost of CO_2 emissions reductions over the analysis period under several different scenarios of the SCC model. The ''average SCC case'' refers to average predicted monetary savings as predicted by the SCC model. The ''95th percentile case'' refers to values calculated using the 95th percentile impacts of the SCC model, which accounts for greater than expected environmental damages. The value for NO_X (in 2015$) is the average of the low and high values used in DOE's analysis.

[15] As stated above, 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 2015, 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. For the latter, DOE used a range of discount rates, as shown in Table IV.16. From the present value, DOE then calculated the fixed annual payment over a 30-year period, starting in 2017 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.

DOE is well aware that scientific and economic knowledge about the contribution of CO_2 and other GHG emissions to changes in the future global climate and the potential resulting damages to the world economy continues to evolve rapidly. Thus, any value placed in this proposed rulemaking on reducing CO_2 emissions is subject to change. DOE, together with other federal agencies, will continue to review various methodologies for estimating the monetary value of reductions in CO_2 and other GHG emissions. This ongoing review will consider any comments on this subject that are part of the public record for this and other rulemakings, as well as other methodological assumptions and issues. However, consistent with DOE's legal obligations, and taking into account the uncertainty involved with this particular issue, DOE has included in this proposed rulemaking the most recent values and analyses resulting from the ongoing interagency review process.

Although adding the value of consumer savings to the values of emission reductions provides a valuable perspective, two issues should be considered. First, the national operating savings are domestic U.S. consumer monetary savings that would occur as a result of market transactions, while the value of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and CO_2 savings are performed with different methods that use quite different time frames for analysis. The national operating cost savings is measured for the lifetime of manufactured homes shipped in the 30-year period after the compliance date. The SCC values, on the other hand, reflect the present value of future climate-related impacts resulting from the emission of one ton of CO_2 in each year. These impacts would go well beyond 2100.

V. Regulatory Review

A. Executive Order 12866

Section 1(b)(1) of Executive Order 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 this proposed standards address are as follows:

(1) Under current federal standards, manufactured homes typically conserve less energy than comparably built site-built and modular homes, and.

(2) There are external benefits resulting from improved energy conservation in manufactured housing. These benefits include externalities related to environmental protection and energy security that are not reflected in energy prices, such as reduced emissions of greenhouse gases.

DOE has determined that this regulatory action is an ''economically significant regulatory action'' under section 3(f)(1) of Executive Order 12866. Accordingly, section 6(a)(3) of the Executive Order requires that DOE prepare a regulatory impact analysis (RIA) on this proposed rule and that the Office of Information and Regulatory Affairs (OIRA) in OMB review this proposed rule. DOE has presented the proposed rule and supporting documents, including the RIA, to OIRA for review and has included these documents in the rulemaking record. The assessments prepared pursuant to Executive Order 12866 can be found in chapter 11 of the TSD for this rulemaking. They are available for public review in the Resource Room of DOE's Building Technologies Program, 950 L'Enfant Plaza SW., Suite 600, Washington, DC 20024, (202) 586–2945, between 9:00 a.m. and 4:00 p.m., Monday through Friday, except federal holidays.

DOE also has reviewed this regulation pursuant to Executive Order 13563, issued on January 18, 2011 (76 FR 3281, Jan. 21, 2011). Executive Order 13563 is supplemental to and reaffirms the principles, structures, and definitions governing regulatory review established in Executive Order 12866. To the extent permitted by law, federal agencies are required by these Executive Orders to, among other things:

(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.

For the reasons stated in the chapter 11 of the TSD and in section III of the document, DOE believes that this proposed rule is consistent with these principles.

B. Executive Order 13563

DOE has also reviewed this regulation pursuant to Executive Order 13563 (*see* 76 FR 3281, Jan. 21, 2011), which is supplemental to, and explicitly reaffirms the principles, structures, and definitions governing regulatory review established in Executive Order 12866. To the extent permitted by law, agencies are required by Executive Order 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 that Executive Order 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, the Office of Information and Regulatory Affairs has emphasized that such techniques may include ''identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes.'' This proposed rule is consistent with these principles, including that, to the extent permitted

by law, agencies adopt a regulation only upon a reasoned determination that its benefits justify its costs and select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits.

C. Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of an initial regulatory flexibility analysis (IRFA) 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 Executive Order 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. DOE has made its procedures and policies available on the Office of the General Counsel's Web site (*www.energy.gov/gc/office-general-counsel*). DOE has prepared the following IRFA for small manufacturers of manufactured homes that are the subject of this proposed rulemaking.

For the manufacturers of manufactured homes, the Small Business Administration (SBA) has set a size threshold, 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. 65 FR 30836, 30848 (May 15, 2000), as amended at 65 FR 53533, 53544 (Sept. 5, 2000) and codified at 13 CFR part 121. The size standards are listed by NAICS code and industry description and are available at *http://www.sba.gov/content/table-small-business-size-standards*. The covered manufacturers are classified under NAICS 321991, ''Manufactured Home (Mobile Home) Manufacturing.'' The SBA sets a threshold of 500 employees or less for an entity to be considered as a small business for this category.

DOE reviewed the potential standards considered in this NOPR under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003. To better assess the potential impacts of this rulemaking on small entities, DOE conducted a more focused inquiry of the companies that could be small business manufacturers of manufactured homes. During its market survey, DOE used available public information to identify potential small manufacturers. DOE's research involved industry trade association membership directories, information from previous rulemakings, individual company Web sites, and market research tools (*e.g.,* Hoover's reports) to create a list of companies that manufacture or sell manufactured homes covered by this rulemaking.

To assess the potential impacts of this rulemaking on small entities, DOE conducted a focused inquiry of the companies that could be small business manufacturers of manufactured homes. During its market survey, DOE used available public information to identify potential small manufacturers. DOE's research involved individual company Web sites and market research tools (*e.g.,* Hoovers reports [16]) to create a list of companies that manufacture homes covered by this rulemaking. DOE also asked stakeholders and industry representatives if they were aware of any other small manufacturers.

DOE identified forty-six manufacturers of manufactured homes. Of the forty-six, DOE identified twenty-five manufacturers that qualified as small businesses. All small manufacturers identified are domestic manufacturers. DOE contacted all 25 identified manufactured home manufacturers for interviews. DOE spoke with two small manufacturers.

During discussions with small manufacturers, DOE asked participating companies to describe their major concerns with regard to the rulemaking. The primary concern cited by small manufacturers was the potential for an energy conservation standard to result in a shrinking market for manufactured homes. Manufacturers noted two possible reasons. First, they were concerned that the standard would be set at a level where the economics do not make sense for the home purchaser. One manufacturer specifically requested the Department perform an analysis that showed the proposed level would result in cost-savings for the home owner. Second, the manufacturers noted the possibility that cost increases for the baseline homes could potentially price out some consumers, specifically lower income consumers. One of the small manufacturers noted that the market for the minimally compliant homes is dominated by much larger manufacturers. In particular, they noted Clayton Homes is the biggest player in that market with roughly half of the overall market for manufactured homes.

Based on HUD data, research reports, and SEC filings, as described in section IV.C and chapter 12 of the TSD, DOE understands the retail prices, markups, and manufacturer production costs used in its manufacturer impact analysis are representative of the industry. DOE estimates that the proposed rule would reduce INPV by 0.4 to 5.1 percent. DOE did not receive sufficient quantitative data to conclude that small manufacturer would experience impacts that are substantially different from the industry-at-large.

Since the proposed standards could cause competitive concerns for small manufacturers, DOE cannot certify that the proposed standards would not have a significant impact on a substantial number of small businesses. DOE requests additional information and data regarding the number and market share of domestic small manufacturers of manufactured homes. DOE also requested information on the conversion costs small manufacturers would face and on other potential small business impacts related to the proposed energy conservation standards.

D. Paperwork Reduction Act

This rulemaking does not include any information collection requirements subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 *et seq.*).

E. National Environmental Policy Act

DOE is preparing a draft Environmental Assessment (EA) pursuant to the Council on Environmental Quality's Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR parts 1500–1508), the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 *et seq.*), DOE's National Environmental Policy Act (NEPA) Implementing Procedures (10 CFR part 1021), and DOE Order 451.1B. DOE is preparing the draft EA in parallel with this rulemaking, and it will be posted to the DOE Web site separately. Reduced emissions of air pollutants and greenhouse gases associated with electricity production and fuel usage are discussed in section IV.D of this **SUPPLEMENTARY INFORMATION**.

F. Executive Order 13132

Executive Order 13132, ''Federalism,'' 64 FR 43255 (August 4, 1999), imposes certain requirements on 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

[16] Hoovers. *http://www.hoovers.com/.*

Executive Order also requires agencies to have a 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 action and has determined that it will not pre-empt State law. This action impacts energy efficiency requirements for manufacturers of manufactured homes. Accordingly, no further action is required by Executive Order 13132.

G. Executive Order 12988

With respect to the review of existing regulations and the promulgation of new regulations, section 3(a) of Executive Order 12988, ''Civil Justice Reform,'' 61 FR 4729 (February 7, 1996), imposes on Executive agencies the general duty to adhere to the following requirements: (1) Eliminate drafting errors and ambiguity; (2) write regulations to minimize litigation; and (3) provide a clear legal standard for affected conduct, rather than a general standard, and promote simplification and burden reduction. Regarding the review required by section 3(a), section 3(b) of Executive Order 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 Executive Order 12988 requires Executive agencies to review regulations in light of applicable standards in sections 3(a) and 3(b) to determine either that those standards are met or it is unreasonable to meet one or more of them. DOE has completed the required review and preliminarily has determined that, to the extent permitted by law, this proposed rule meets the relevant standards of Executive Order 12988.

H. Unfunded Mandates Reform Act

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, sec. 201 (codified at 2 U.S.C. 1531). For an amended 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. *See* 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 small governments. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. *See* 62 FR 12820. DOE's policy statement is also available at *http://energy.gov/gc/office-general-counsel*.

This proposed rule does not contain a federal intergovernmental or private sector mandate, as those terms are defined in UMRA.

I. Family and General Government Appropriations Act

Section 654 of the Family and General Government Appropriations Act of 1999 (Pub. L. 105–277) requires federal agencies to issue a Family Policymaking Assessment for any proposed rule that may affect family well-being. This proposed rule would not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has preliminarily concluded that it is not necessary to prepare a Family Policymaking Assessment.

J. Executive Order 12630

DOE has determined, under Executive Order 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights,'' 53 FR 8859 (March 18, 1988), that this proposed rule would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

K. Treasury and General Government Appropriations Act

Section 515 of the Treasury and General Government Appropriations Act of 2001 (44 U.S.C. 3516, note) provides for agencies to review most disseminations of information to the public under guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (February 22, 2002), and DOE's guidelines were published at 67 FR 62446 (October 7, 2002). DOE has reviewed this proposed rule under the OMB and DOE guidelines and preliminarily has concluded that it is consistent with applicable policies in those guidelines.

L. 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 a Statement of Energy Effects for any proposed 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 or regulation, and that: (1) Is a significant regulatory action under Executive Order 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 proposed 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 preliminarily has concluded that this regulatory action, which sets forth energy conservation standards for manufactured homes, is not a significant energy action because the proposed 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 for this proposed rule.

M. Section 32 of the Federal Energy Administration Act of 1974

Under section 301 of the Department of Energy Organization Act (Pub. L. 95–91), 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). Section 32 provides in part that, where a proposed rule contains or involves use of commercial standards, the rulemaking

must inform the public of the use and background of such standards.

The rule proposed in this notice incorporates testing methods contained in the following commercial standards: The ACCA ''Manual J—Residential Load Calculation (8th Edition)'' (ACCA Manual J); the ACCA ''Manual S—Residential Equipment Selection (2nd Edition)'' (ACCA Manual S); and the PNNL ''Overall *U*-Values and Heating/Cooling Loads—Manufactured Homes'' (Overall *U*-Values and Heating/Cooling Loads—Manufactured Homes).

DOE has evaluated these standards and is unable to conclude whether they fully comply with the requirements of section 32(b) of the Federal Energy Administration Act of 1974, as amended. DOE will consult with the Attorney General and the Chairman of the Federal Trade Commission before prescribing a final rule concerning the impact on competition of requiring manufacturers to use the methods contained in these standards to test various components of manufactured homes.

N. Materials Incorporated by Reference

In this NOPR, DOE proposes to incorporate by reference the test 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 proposes requiring 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 Web site at *http://www.acca.org/*.

DOE also proposes to incorporate by reference the test 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 proposes requiring building heating and cooling equipment to be sized in accordance with ACCA Manual S. ACCA Manual S is readily available on ACCA's Web site at *http://www.acca.org/*.

DOE also proposes to incorporate by reference the test standard titled ''*Overall U-Values and Heating/Cooling Loads—Manufactured Homes*'' *written by* Conner C.C., Taylor, Z.T. of Pacific Northwest Laboratory. This test standard (often referred to as the Battelle Method) is an industry accepted method for calculating the overall thermal transmittance of a manufactured home. DOE proposes requiring manufactured housing manufacturers to calculate the overall thermal transmittance of a manufactured home in accordance with this test standard. This test standard is readily available on the U.S. Department of Housing and Urban Development's Web site at *http://www.huduser.org/portal/publications/manufhsg/uvalue.html*.

VI. Public Participation

A. Attendance at Public Meeting

The time, date, and location of the public meeting are listed in the **DATES** and **ADDRESSES** sections at the beginning of this document. If you plan to attend the public meeting, please notify Ms. Brenda Edwards at (202) 586–2945 or *Brenda.Edwards@ee.doe.gov*. As explained in the **ADDRESSES** section, foreign nationals visiting DOE Headquarters are subject to advance security screening procedures.

B. Procedure for Submitting Prepared General Statements for Distribution

Any person who has plans to present a prepared general statement may request that copies of his or her statement be made available at the public meeting. Such persons may submit requests, along with an advance electronic copy of their statement in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format, to the appropriate address shown in the **ADDRESSES** section at the beginning of this notice. The request and advance copy of statements must be received at least one week before the public meeting and may be emailed, hand-delivered, or sent by U.S. mail. DOE prefers to receive requests and advance copies via email. Please include a telephone number to enable DOE staff to make follow-up contact, if needed.

C. Conduct of Public Meeting

DOE will designate a DOE official to preside at the public meeting and may also use a professional facilitator to aid discussion. 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 public meeting. After the public meeting, interested parties may submit further comments on the proceedings as well as on any aspect of the rulemaking until the end of the comment period.

The public meeting will be conducted in an informal, conference style. DOE will present summaries of comments received before the public meeting, 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 and comment on statements made by others. Participants should be prepared to answer questions by DOE and by other participants concerning these issues. DOE representatives also may ask questions of participants concerning other matters relevant to this rulemaking. The official conducting the public meeting 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 public meeting.

A transcript of the public meeting will be included in the docket, which can be viewed as described in the DOCKET section at the beginning of this proposed rulemaking. 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 before or after the public meeting, but no later than the date provided in the **DATES** section at the beginning of this proposed rule. Interested parties may submit comments using any of the methods described in the **ADDRESSES** section at the beginning of this proposed rule.

1. Submitting Comments via *Regulations.gov*

The *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 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. 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 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 *regulations.gov* cannot be claimed as CBI. Comments received through the Web site will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section below.

DOE processes submissions made through 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 regulations.gov provides after you have successfully uploaded your comment.

2. Submitting Comments via Email, Hand Delivery, or Mail

Comments and documents submitted via email, hand delivery, or mail also will be posted to *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 on 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. Email submissions are preferred. If you submit via mail or hand delivery, please provide all items on a CD, if feasible. It is not necessary to submit printed copies. No facsimiles (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, written in English, and 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

According 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, postal mail, or hand delivery 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. Submit these documents via email or on a CD, if feasible. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

Factors of interest to DOE when evaluating requests to treat submitted information as confidential include: (1) A description of the items, (2) whether and why such items are customarily treated as confidential within the industry, (3) whether the information is generally known by or available from other sources, (4) whether the information has previously been made available to others without obligation concerning its confidentiality, (5) an explanation of the competitive injury to the submitting person which would result from public disclosure, (6) when such information might lose its confidential character due to the passage of time, and (7) why disclosure of the information would be contrary to the public interest.

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 Seeks 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. Relationship With the HUD Code

Potential inconsistencies or conflicts between the proposed rule and the HUD Code, as discussed in detail in section II.B.1 of this document.

2. Scope and Effective Date

The scope and effective date of the proposed rule, as discussed in section III.B.1.a) of the document. DOE requests comment on whether a one-year compliance period would be sufficient for manufacturers to transition their designs, materials, and factory operations and processes in order to comply with the finalized DOE energy conservation standards and for DOE to develop and implement regulations to enforce its standards. DOE also requests comments on what additional lead time should be allowed if it elects to use HUD's existing enforcement system, which would require HUD to adopt the energy standards resulting from this rulemaking. The agency also requests comment on whether there are any particular timing considerations that the agency should consider due to manufacturers choosing to comply with either the prescriptive or thermal envelope compliance paths.

3. Definitions

Proposed additions, exclusions, modifications, and potential inconsistencies among the definitions proposed under this rule, the HUD Code, and the 2015 IECC, as discussed in section III.B.1.b) of this document.

4. Air Barrier

Potential clarification on the meaning of the term ''air barrier,'' as discussed in section III.B.1.b) of this document.

5. Tubular Daylighting Devices

Whether to include tubular daylighting devices in the definition of the term ''fenestration,'' as discussed in section III.B.1.b) of this document.

6. Climate Zones

The proposal to establish four climate zones and the specific categorization of states and counties included in each climate zone, as discussed in section III.B.2.a) of this **SUPPLEMENTARY INFORMATION** and chapter 4 of the TSD. DOE also requests comment on the proposed use of four climate zones relative to adopting the three HUD climate zones and whether there are any potential impacts on manufacturing costs, compliance costs, or other impacts, in particular in Arizona, Texas, Louisiana, Mississippi, Alabama, and

Georgia, where the agency has proposed two different energy efficiency standards within the same state.

7. Home Size

The proposal to establish separate requirements for single- and multi-section manufactured homes, as discussed in section III.B.2.a) of this document.

8. Paths for Compliance With the Building Thermal Envelope Standards

The proposal to establish prescriptive and performance options for achieving compliance with the proposed building thermal envelope requirements, the requirements of each option, and their equivalency in terms of overall thermal performance, as discussed in section III.B.2.b) of this **SUPPLEMENTARY INFORMATION** and chapter 6 of the TSD.

9. Insulated Siding

The proposal to include a requirement similar to section R402.1.3 of the 2015 IECC while excluding the insulated siding specification, as discussed in section III.B.2.b) of this document.

10. U-Factor Alternatives

11. The proposed *U*-factor alternatives and their equivalency with the prescriptive *R*-value requirements for ceiling, wall, and floor insulation, as discussed in section III.B.2.b) of this document.

12. Calculation of Average SHGC

The proposal to include an area-weighted average calculation of SHGC for compliance with § 460.102(c), as discussed in section III.B.2.b) of this document.

13. Insulation Installation Requirements for Floors

Whether the insulation installation requirements in § 460.103, including installation of insulation in floors, may be readily implemented by the manufactured housing industry, as discussed in section III.B.2.c) of this document.

14. Design Criteria for Envelope Sealing

The effectiveness of the prescriptive building thermal envelope sealing requirements, as discussed in section III.B.2.d) of this **SUPPLEMENTARY INFORMATION**.

15. Impact of Envelope Sealing on Indoor Air Quality

The potential impacts associated with the reduction in levels of natural air infiltration (through sealing leaks in the building thermal envelope), if any, relative to the minimum requirements of the HUD Code on reduced indoor air quality, the importance of natural air infiltration for whole-house ventilation strategies in manufactured housing, the relationship between the proposed standards and the mechanical ventilation requirements under the HUD Code, the basis by which the ICC determines a whole-house ventilation strategy is safe, and the minimum total air flow (in ACH units) through a manufactured home that is required to adequately protect public health and safety, as discussed in section V.E of this document.

16. Duct Sealing

The proposed duct sealing and duct leakage requirements, as discussed in section III.B.3.a) of this document.

17. Thermostats and Controls

The proposed requirements for thermostats and controls, and any potential inconsistencies with the HUD Code, as discussed in III.B.3.b) of this document.

18. Demand Recirculation Systems

The initial decision not to propose requirements related to demand recirculation systems in this rule, as discussed in section III.B.3.c) of this document.

19. Drain Water Heat Recovery Units

The initial decision not to propose requirements related to drain water heat recovery units, as discussed in section III.B.3.c) of this document.

20. Equipment Sizing

The proposed requirements for equipment sizing and the applicability of ACCA Manuals S and J, as discussed in section III.B.3.e) of this document.

21. Lighting Equipment Standards

The initial determination not to propose lighting equipment standards specific to manufactured housing, as discussed in section III.C.6 of this document.

22. Simulated Performance Alternative

The exclusion of a simulated performance alternative as a pathway to compliance, as discussed in section III.C.7 of this document.

23. Waivers and Exception Relief

A process for authorizing manufacturers to obtain waivers or exception relief from the energy conservation requirements, as discussed in section II.B.3 of this document.

24. Compliance and Enforcement Program Options

The potential options DOE may consider in a future rulemaking regarding compliance and enforcement, as discussed in section III.E of this document.

25. Compliance and Enforcement Program Costs and Time Requirements

The estimated costs (only direct compliance and enforcement costs, not engineering costs for redesign) and time (design compliance review, inspection frequency and duration, administrative procedures) associated with the potential compliance and enforcement options, as discussed in section III.E of this document.

26. Increased Costs of Components

The assumptions underlying DOE's analyses associated with the increased costs of manufactured home components, as discussed in section IV.A of this document.

27. Lifecycle Cost Analysis

The methodology and initial findings of the lifecycle cost analysis, as discussed in IV.A of this **SUPPLEMENTARY INFORMATION** and chapter 8 of the TSD.

28. Affordability

The affordability of the proposed rule, with respect to the increased purchase cost, reduced operating costs (energy bills), and total lifecycle cost, as discussed in IV.A of this **SUPPLEMENTARY INFORMATION** and chapter 8 of the TSD.

29. Manufacturer Impacts Analysis—Markups

Whether manufacturer and retailer mark-ups for the base-case and standards case other than the primary estimate should be considered. (*e.g.,* a combined mark-up of 2.30 has historically been used in the past to assess combined manufacturer and retailer mark-ups to determine potential first cost impacts on consumers), as discussed in IV.B of this **SUPPLEMENTARY INFORMATION** and chapter 12 of the TSD.

30. Shipments Analysis

The methodology and initial findings of the shipments analysis, as discussed in section IV.B of this **SUPPLEMENTARY INFORMATION** and chapter 10 of the TSD.

31. Shipment Growth Rate

The estimate of the future growth rate of manufactured home shipments, as discussed in section IV.C of this **SUPPLEMENTARY INFORMATION** and chapter 10 and appendix 11A of the TSD.

32. Price Elasticity

The estimate of the price elasticity of demand of manufactured homes, as

discussed in section IV.C of this **SUPPLEMENTARY INFORMATION** and chapter 10 and appendix 11A of the TSD.

33. National Impacts Analysis

The methodology and initial findings of the national impacts analysis, as discussed in section IV.C of this **SUPPLEMENTARY INFORMATION** and chapter 11 of the TSD.

34. Emissions Analysis

The methodology and results of the emissions analysis and the proper monetization of emissions, as discussed in section IV.D of this **SUPPLEMENTARY INFORMATION** and chapter 13 of the TSD.

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.

Issued in Washington, DC, on May 20, 2016.

David Friedman,

Principal Deputy Assistant Secretary, Energy Efficiency and Renewable Energy.

For the reasons stated in the preamble, DOE proposes to add part 460 of title 10 of the Code of Federal Regulations as set forth below:

PART 460—ENERGY CONSERVATION STANDARDS FOR MANUFACTURED HOMES

Subpart A—General

Sec.
460.1 Scope.
460.2 Definitions.
460.3 Materials incorporated by reference.

Subpart B—Building Thermal Envelope

460.101 Climate zones.
460.102 Building thermal envelope requirements.
460.103 Installation of insulation.
460.104 Building thermal envelope air leakage.

Subpart C—HVAC, Service Water Heating, and Equipment Sizing

460.201 Duct systems.
460.202 Thermostats and controls.
460.203 Service water heating.
460.204 Mechanical ventilation fan efficacy.
460.205 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. A manufactured home that is manufactured on or after the date one year following issuance of the final rule must comply with all applicable requirements of this part.

§ 460.2 Definitions.

As used in this part—

Accessible means admitting close approach as a result of not being guarded by locked doors, elevation, or other effective means.

Air barrier means material or materials assembled and joined together to provide a barrier to air leakage through the building thermal envelope.

Automatic means self-acting or operating by its own mechanism when actuated by some impersonal influence.

Building thermal envelope means exterior walls, floor, ceiling or roof, and any other building elements 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.

Circulating hot water 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.

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 heated or cooled, or an area, room, or space that has a fixed opening directly into an adjacent area, room, or space that is enclosed within the building thermal envelope and that is directly heated or cooled.

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 main ceiling.

Dropped soffit means a secondary nonstructural ceiling that is hung below the 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 a wall and normally projects beyond the side of the manufactured home.

Equipment includes material, appliances, devices, fixtures, fittings, or accessories both in the construction of, and in the plumbing, heating, cooling, and electrical systems of, a manufactured home.

Exterior wall means a wall 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.

Infiltration means the uncontrolled air leakage into a manufactured home caused by the pressure effects of wind and/or the effect of differences in the indoor and outdoor air density.

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 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 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.

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 ($h \cdot ft^2 \cdot$ °F/Btu).

Rough opening means an opening in the 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.

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/$h \cdot ft^2 \cdot$ °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/$h \cdot ft^2 \cdot$; °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.

(a) *General.* We incorporate by reference the following standards into part 460. The material listed has been approved for incorporation by reference by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Any subsequent amendment to a standard by the standard-setting organization will not affect the DOE regulations unless and until amended by DOE. Material is incorporated as it exists on the date of the approval and a notice of any change in the material will be published in the Federal Register. All approved material is available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202–741–6030 or go to *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.* This material also is available for inspection at U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, 6th Floor, 950 L'Enfant Plaza SW., Washington, DC 20024, 202–586–2945, between 9 a.m. and 4 p.m., Monday through Friday, except Federal holidays. Standards can be obtained from the sources listed.

(b) *ACCA.* Air Conditioning Contractors of America, Inc., 2800 S. Shirlington Road, Suite 300, Arlington, VA 22206, 703–575–4477, *http://www.acca.org/.*

(1) *Manual J—Residential Load Calculation (8th Edition).* IBR approved for § 460.205 of subpart C.

(2) *Manual S—Residential Equipment Selection (2nd Edition).* IBR approved for § 460.205 of subpart C.

(c) *HUD.* U.S. Department of Housing and Urban Development, *http://www.huduser.org/portal/publications/manufhsg/uvalue.html*, 800–245–2691.

(1) *Overall U-Values and Heating/Cooling Loads—Manufactured Homes.* Conner C.C., Taylor, Z.T., Pacific Northwest Laboratory, published February 1, 1992, IBR approved for § 460.102 of subpart B.

(2) Reserved.

Subpart B—Building Thermal Envelope

§ 460.101 Climate zones.

Manufactured homes must comply with the requirements applicable to one or more of the climate zones set forth in Figure 460.101 and Tables 460.101–1 and 460.101–2 of this section.

Figure 460.101 Climate Zones

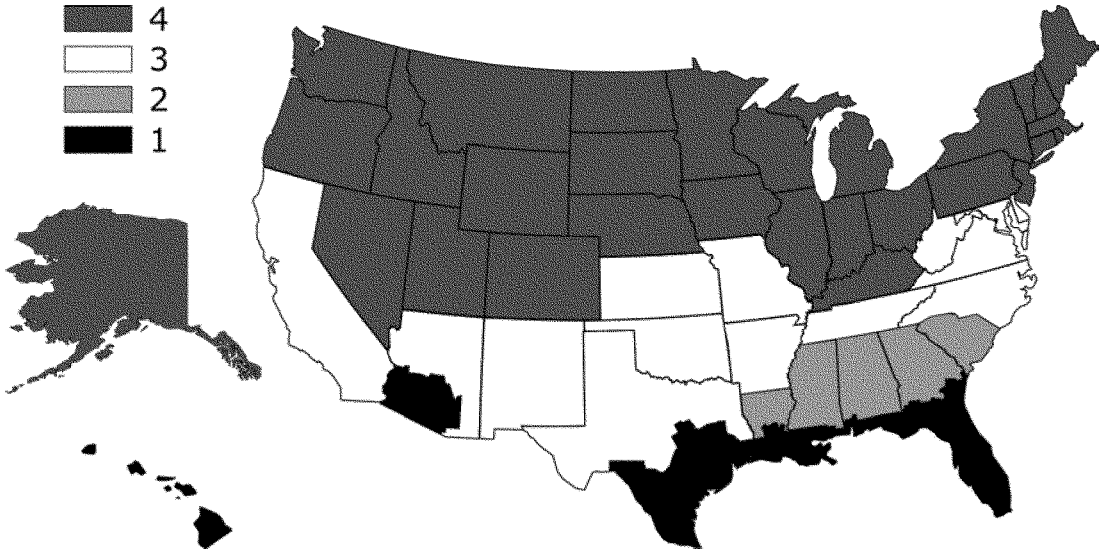


TABLE 460.101–1—U.S. STATES AND TERRITORIES WITH ONE CLIMATE ZONE

Zone 1	Zone 2	Zone 3	Zone 4
Florida	South Carolina	Arkansas	Alaska.
Hawaii		Delaware	Colorado.
American Samoa		District of Columbia	Connecticut.
Guam		Kansas	Idaho.
The Commonwealth of Puerto Rico		Kentucky	Illinois.
U.S. Virgin Islands		Maryland	Indiana.
		Missouri	Iowa.
		New Mexico	Maine.
		North Carolina	Massachusetts.
		Oklahoma	Michigan.
		Tennessee	Minnesota.
		Virginia	Montana.
		West Virginia	Nebraska.
			Nevada.
			New Hampshire.
			New Jersey.
			New York.
			North Dakota.
			Ohio.
			Oregon.
			Pennsylvania.
			Rhode Island.
			South Dakota.
			Utah.
			Vermont.
			Washington.
			Wisconsin.
			Wyoming.

TABLE 460.101–2—U.S. STATES WITH MORE THAN ONE CLIMATE ZONE

State	Zone	Counties	Counties	Counties	Counties	Counties
Alabama	1	Baldwin	Mobile.			
	2	Autauga	Barbour	Bibb	Blount	Bullock.
		Butler	Calhoun	Chambers	Cherokee	Chilton.
		Choctaw	Clarke	Clay	Cleburne	Coffee.
		Colbert	Conecuh	Coosa	Covington	Crenshaw.
		Cullman	Dale	Dallas	DeKalb	Elmore.
		Escambia	Etowah	Fayette	Franklin	Geneva.
		Greene	Hale	Henry	Houston	Jackson.
		Jefferson	Lamar	Lauderdale	Lawrence	Lee.
		Limestone	Lowndes	Macon	Madison	Marengo.
		Marion	Marshall	Monroe	Montgomery	Morgan.
		Perry	Pickens	Pike	Randolph	Russell.

TABLE 460.101–2—U.S. STATES WITH MORE THAN ONE CLIMATE ZONE—Continued

State	Zone	Counties	Counties	Counties	Counties	Counties
		St. Clair	Shelby	Sumter	Talladega	Tallapoosa.
		Tuscaloosa	Walker	Washington	Wilcox	Winston.
Arizona	1	La Paz	Maricopa	Pima	Pinal	Yuma.
	3	Apache	Cochise	Coconino	Graham	Greenlee.
		Mohave	Navajo	Santa Cruz	Yavapai.	
Georgia	1	Appling	Atkinson	Bacon	Baker	Berrien.
		Brantley	Brooks	Bryan	Camden	Charlton.
		Chatham	Clinch	Colquitt	Cook	Decatur.
		Echols	Effingham	Evans	Glynn	Grady.
		Jeff Davis	Lanier	Liberty	Long	Lowndes.
		McIntosh	Miller	Mitchell	Pierce	Seminole.
		Tattnall	Thomas	Toombs	Ware	Wayne.
	2	Baldwin	Banks	Barrow	Bartow	Ben Hill.
		Bibb	Bleckley	Bulloch	Burke	Butts.
		Calhoun	Candler	Carroll	Catoosa	Chattahoochee.
		Chattooga	Cherokee	Clarke	Clay	Clayton.
		Cobb	Coffee	Columbia	Coweta	Crawford.
		Crisp	Dade	Dawson	DeKalb	Dodge.
		Dooly	Dougherty	Douglas	Early	Elbert.
		Emanuel	Fannin	Fayette	Floyd	Forsyth.
		Franklin	Fulton	Gilmer	Glascock	Gordon.
		Greene	Gwinnett	Habersham	Hall	Hancock.
		Haralson	Harris	Hart	Heard	Henry.
		Houston	Irwin	Jackson	Jasper	Jefferson.
		Jenkins	Johnson	Jones	Lamar	Laurens.
		Lee	Lincoln	Lumpkin	McDuffie	Macon.
		Madison	Marion	Meriwether	Monroe	Montgomery.
		Morgan	Murray	Muscogee	Newton	Oconee.
		Oglethorpe	Paulding	Peach	Pickens	Pike.
		Polk	Pulaski	Putnam	Quitman	Rabun.
		Randolph	Richmond	Rockdale	Schley	Screven.
		Spalding	Stephens	Stewart	Sumter	Talbot.
		Taliaferro	Taylor	Telfair	Terrell	Tift.
		Towns	Treutlen	Troup	Turner	Twiggs.
		Union	Upson	Walker	Walton	Warren.
		Washington	Webster	Wheeler	White	Whitfield.
		Wilcox	Wilkes	Wilkinson	Worth.	
Louisiana	1	Acadia	Allen	Ascension	Assumption	Avoyelles.
		Beauregard	Calcasieu	Cameron	East Baton Rouge	East Feliciana.
		Evangeline	Iberia	Iberville	Jefferson	Jefferson Davis.
		Lafayette	Lafourche	Livingston	Orleans	Plaquemines.
		Pointe Coupee	Rapides	St. Bernard	St. Charles	St. Helena.
		St. James	St. John the Baptist	St. Landry	St. Martin	St. Mary.
		St. Tammany	Tangipahoa	Terrebonne	Vermilion	Washington.
		West Baton Rouge	West Feliciana.			
	2	Bienville	Bossier	Caddo	Caldwell	Catahoula.
		Claiborne	Concordia	De Soto	East Carroll	Franklin.
		Grant	Jackson	LaSalle	Lincoln	Madison.
		Morehouse	Natchitoches	Ouachita	Red River	Richland.
		Sabine	Tensas	Union	Vernon	Webster.
		West Carroll	Winn.			
Mississippi	1	Hancock	Harrison	Jackson	Pearl River	Stone.
	2	Adams	Alcorn	Amite	Attala	Benton.
		Bolivar	Calhoun	Carroll	Chickasaw	Choctaw.
		Claiborne	Clarke	Clay	Coahoma	Copiah.
		Covington	DeSoto	Forrest	Franklin	George.
		Greene	Grenada	Hinds	Holmes	Humphreys.
		Issaquena	Itawamba	Jasper	Jefferson	Jefferson Davis.
		Jones	Kemper	Lafayette	Lamar	Lauderdale.
		Lawrence	Leake	Lee	Leflore	Lincoln.
		Lowndes	Madison	Marion	Marshall	Monroe.
		Montgomery	Neshoba	Newton	Noxubee	Oktibbeha.
		Panola	Perry	Pike	Pontotoc	Prentiss.
		Quitman	Rankin	Scott	Sharkey	Simpson.
		Smith	Sunflower	Tallahatchie	Tate	Tippah.
		Tishomingo	Tunica	Union	Walthall	Warren.
		Washington	Wayne	Webster	Wilkinson	Winston.
		Yalobusha	Yazoo.			
Texas	1	Anderson	Angelina	Aransas	Atascosa	Austin.
		Bandera	Bastrop	Bee	Bell	Bexar.
		Bosque	Brazoria	Brazos	Brooks	Burleson.
		Caldwell	Calhoun	Cameron	Chambers	Colorado.

TABLE 460.101–2—U.S. STATES WITH MORE THAN ONE CLIMATE ZONE—Continued

State	Zone	Counties	Counties	Counties	Counties	Counties
		Comal	Coryell	DeWitt	Dimmit	Duval.
		Edwards	Falls	Fayette	Fort Bend	Freestone.
		Frio	Galveston	Goliad	Gonzales	Grimes.
		Guadalupe	Hardin	Harris	Hays	Hidalgo.
		Hill	Houston	Jackson	Jasper	Jefferson.
		Jim Hogg	Jim Wells	Karnes	Kenedy	Kinney.
		Kleberg	La Salle	Lavaca	Lee	Leon.
		Liberty	Limestone	Live Oak	Madison	Matagorda.
		Maverick	McLennan	McMullen	Medina	Milam.
		Montgomery	Newton	Nueces	Orange	Polk.
		Real	Refugio	Robertson	San Jacinto	San Patricio.
		Starr	Travis	Trinity	Tyler	Uvalde.
		Val Verde	Victoria	Walker	Waller	Washington.
		Webb	Wharton	Willacy	Williamson	Wilson.
		Zapata	Zavala.			
	3	Andrews	Archer	Armstrong	Bailey	Baylor.
		Blanco	Borden	Bowie	Brewster	Briscoe.
		Brown	Burnet	Callahan	Camp	Carson.
		Cass	Castro	Cherokee	Childress	Clay.
		Cochran	Coke	Coleman	Collin	Collingsworth.
		Comanche	Concho	Cooke	Cottle	Crane.
		Crockett	Crosby	Culberson	Dallam	Dallas.
		Dawson	Deaf Smith	Delta	Denton	Dickens.
		Donley	Eastland	Ector	Ellis	El Paso.
		Erath	Fannin	Fisher	Floyd	Foard.
		Franklin	Gaines	Garza	Gillespie	Glasscock.
		Gray	Grayson	Gregg	Hale	Hall.
		Hamilton	Hansford	Hardeman	Harrison	Hartley.
		Haskell	Hemphill	Henderson	Hockley	Hood.
		Hopkins	Howard	Hudspeth	Hunt	Hutchinson.
		Irion	Jack	Jeff Davis	Johnson	Jones.
		Kaufman	Kendall	Kent	Kerr	Kimble.
		King	Knox	Lamar	Lamb	Lampasas.
		Lipscomb	Llano	Loving	Lubbock	Lynn.
		McCulloch	Marion	Martin	Mason	Menard.
		Midland	Mills	Mitchell	Montague	Moore
		Morris	Motley	Nacogdoches	Navarro	Nolan.
		Ochiltree	Oldham	Palo Pinto	Panola	Parker.
		Parmer	Pecos	Potter	Presidio	Rains.
		Randall	Reagan	Red River	Reeves	Roberts.
		Rockwall	Runnels	Rusk	Sabine	San Augustine.
		San Saba	Schleicher	Scurry	Shackelford	Shelby.
		Sherman	Smith	Somervell	Stephens	Sterling.
		Stonewall	Sutton	Swisher	Tarrant	Taylor.
		Terrell	Terry	Throckmorton	Titus	Tom Green.
		Upshur	Upton	Van Zandt	Ward	Wheeler.
		Wichita	Wilbarger	Winkler	Wise	Wood.
		Yoakum	Young.			

§ 460.102 Building thermal envelope requirements.

(a) *Compliance options.* The building thermal envelope of a manufactured home 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 minimum *R*-value, and the maximum *U*-factor and SHGC, requirements set forth in Table 460.102–1.

TABLE 460.102–1—BUILDING THERMAL ENVELOPE PRESCRIPTIVE REQUIREMENTS

Climate zone	Ceiling insulation *R*-value	Wall insulation *R*-value	Floor insulation *R*-value	Window *U*-factor	Skylight *U*-factor	Door *U*-factor	Glazed fenestration SHGC
1	30	13	13	0.35	0.75	0.40	0.25
2	30	13	13	0.35	0.75	0.40	0.33
3	30	21	19	0.35	0.55	0.40	0.33
4	38	21	30	0.32	0.55	0.40	Not Applicable

(2) For the purpose of compliance with the 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) Ceiling insulation must have either a uniform thickness or a uniform density.

(4) 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 § 460.102(b)(1) for climate zone 4.

(5) 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 Table 460.102–1.

(6) *U*-factor alternatives to *R*-value requirements. Compliance with paragraph (b)(1) of this section may be determined using the maximum *U*-factor values set forth in Table 460.102–2, 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 Table 460.102–1.

(7) The total area of glazed fenestration must be no greater than 12 percent of the area of the floor.

TABLE 460.102–2—*U*-FACTOR ALTERNATIVES TO *R*-VALUE REQUIREMENTS

Climate zone	Ceiling *U*-factor	Wall *U*-factor	Floor *U*-factor
1	0.0446	0.0943	0.0776
2	0.0446	0.0943	0.0776
3	0.0446	0.0628	0.0560
4	0.0377	0.0628	0.0322

(c) *Performance requirements.* (1) The building thermal envelope must have a U_o that is less than or equal to the value specified in Table 460.102–3.

TABLE 460.102–3—BUILDING THERMAL ENVELOPE PERFORMANCE REQUIREMENTS

Climate zone	Single-section U_o	Multi-section U_o
1	0.087	0.084
2	0.087	0.084
3	0.070	0.068
4	0.059	0.056

(2) Area-weighted average vertical fenestration *U*-factor must not exceed 0.48 in climate zone 3 or 0.40 in climate zone 4.

(3) Area-weighted average skylight *U*-factor must not exceed 0.75 in climate zone 3 and climate zone 4.

(4) Windows, skylights and doors containing more than 50 percent glazing by area must satisfy the SHGC requirements established in Table 460.102–1 on the basis of an area-weighted average.

(d) *Determination of compliance with paragraph (b) of this section.*

(1)–(2) [Reserved].

(3) The total *R*-value of a component is the sum of the *R*-values of each layer of insulation that comprise the component.

(4)–(5) [Reserved].

(6) The *U*-factor for certain fenestration products and doors may be determined in accordance with the prescriptive default values set forth in Tables 460.102–4 and 460.102–5.

(7) [Reserved].

(8) The SHGC of certain glazed fenestration products may be determined in accordance with the prescriptive glazed fenestration default values set forth in Table 460.102–6.

(e) *Determination of compliance with § 460.102(c).* (1) U_o must be determined in accordance with Overall *U*-Values and Heating/Cooling Loads—Manufactured Homes (incorporated by reference; see § 460.3) with the following exceptions:

(i)–(ii) [Reserved].

(iii) The *U*-factor for certain fenestration products and doors may be determined in accordance with the prescriptive default values set forth in Tables 460.102–4 and 460.102–5 of this section.

(2) [Reserved].

(3) The SHGC of certain glazed fenestration products may be determined in accordance with the prescriptive glazed fenestration default values set forth in Table 460.102–6.

TABLE 460.102–4—DEFAULT GLAZED FENESTRATION *U*-FACTOR VALUES

Frame type	Window *U*-factor	Window *U*-factor	Skylight *U*-factor	
			Single pane	Double pane
Metal	1.20	0.80	2.00	1.30
Metal with Thermal Break	1.10	0.65	1.90	1.10
Nonmetal or Metal Clad	0.95	0.55	1.75	1.05
Glazed Block	0.60			

TABLE 460.102–5—DEFAULT DOOR *U*-FACTOR VALUES

Door type	*U*-factor
Uninsulated Metal	1.20
Insulated Metal	0.60
Wood	0.50
Insulated, nonmetal edge, maximum 45 percent glazing, any glazing double pane	0.35

TABLE 460.102–6—DEFAULT GLAZED FENESTRATION SHGC VALUES

	Single pane		Double pane		Glazed block
	Clear	Tinted	Clear	Tinted	
SHGC	0.8	0.7	0.7	0.6	0.6

§ 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.

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 a 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.
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.
Narrow cavities	Batts in narrow cavities must be cut to fit or narrow cavities must be filled by insulation that upon installation readily conforms to the available cavity space.
Rim joists	Rim joists must be insulated.
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 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. 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. All gaps and penetrations in the ceiling, 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.

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 weatherstripped 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 air barrier or the interior finish materials with caulk, foam, gasket, or other suitable material.
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.
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.
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 ceiling, and the junction of the bottom plate and the 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 Water Heating, and Equipment Sizing

§ 460.201 Duct system.

(a) Each manufactured home must be equipped with a duct system, which may include air handlers and filter boxes, that 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 when tested according to paragraph (b) of this section. Building framing cavities must not be used as ducts or plenums.

(b) [Reserved].

§ 460.202 Thermostats and controls.

(a) At least one thermostat must be provided for each separate heating and cooling system installed by the manufacturer.

(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;

(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) 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 water heating.

(a) Service water heating systems installed by the manufacturer must be installed according to the service water heating manufacturer's installation instructions. Where service water heating systems are installed by the manufacturer, the manufacturer must ensure that any maintenance instructions received from the service water heating system manufacturer are provided with the manufactured home.

(b) Any automatic and manual controls, temperature sensors, pumps associated with service water heating systems must be accessible.

(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 water heating 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.

TABLE 460.204—MECHANICAL VENTILATION SYSTEM FAN EFFICACY

Fan type description	Minimum efficacy (cfm/watt)
Range hoods (all air flow rates)	2.8
In-line fans (all air flow rates)	2.8
Bathroom and utility room fans (10 cfm ≤ air flow rate <90 cfm)	1.4
Bathroom and utility room fans (air flow rate ≥90 cfm)	2.8

(b) Mechanical ventilation fans that are integral to heating, ventilating, and air conditioning equipment must be powered by an electronically commutated motor.

§ 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).

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