DEPARTMENT OF ENERGY

10 CFR Part 431

[EERE–2017–BT–STD–0009]

RIN 1905–AD79

Energy Conservation Program: Energy Conservation Standards for Walk-In Coolers and Freezers

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

ACTION: Notice of proposed rulemaking and announcement of public meeting.

SUMMARY: The Energy Policy and Conservation Act, as amended (''EPCA''), prescribes energy conservation standards for various consumer products and certain commercial and industrial equipment, including walk-in coolers and freezers (''walk-ins'' or ''WICFs''). EPCA also requires the U.S. Department of Energy (''DOE'') to periodically determine whether more-stringent, standards would be technologically feasible and economically justified, and would result in significant energy savings. In this notice of proposed rulemaking (''NOPR''), DOE proposes amended energy conservation standards for walk-ins, and also announces a public meeting to receive comment on these proposed standards and associated analyses and results.

DATES:

Comments: DOE will accept comments, data, and information regarding this NOPR no later than November 6, 2023.

Meeting: DOE will hold a public meeting via webinar on Wednesday, September 27, 2023, from 1:00 p.m. to 4:00 p.m. See section VII, ''Public Participation,'' for webinar registration information, participant instructions and information about the capabilities available to webinar participants.

Comments regarding the likely competitive impact of the proposed standard should be sent to the Department of Justice contact listed in the **ADDRESSES** section on or before October 5, 2023.

Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *www.regulations.gov* under docket number EERE–2017–BT–STD–0009. Follow the instructions for submitting comments. Alternatively, interested persons may submit comments, identified by docket number EERE–2017–BT–STD–0009, by any of the following methods:

(1) *Email: WICF2017STD0009@ee.doe.gov.* Include the docket number EERE–2017–BT–STD–0009 in the subject line of the message.

(2) *Non-electronic submissions:* Please contact (202) 287–1445 for instructions if an electronic copy cannot be submitted.

No telefacsimiles (''faxes'') will be accepted. For detailed instructions on submitting comments and additional information on this process, see section VII of this document.

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

The docket web page can be found at *www.regulations.gov/docket/EERE-2017-BT-STD-0009.* The docket web page contains instructions on how to access all documents, including public comments, in the docket. See section VII of this document for information on how to submit comments through *www.regulations.gov.*

EPCA requires the Attorney General to provide DOE a written determination of whether the proposed standard is likely to lessen competition. The U.S. Department of Justice Antitrust Division invites input from market participants and other interested persons with views on the likely competitive impact of the proposed standard. Interested persons may contact the Division at *energy.standards@usdoj.gov* on or before the date specified in the **DATES** section. Please indicate in the ''Subject'' line of your email the title and Docket Number of this proposed rulemaking.

FOR FURTHER INFORMATION CONTACT:

Mr. Troy Watson, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, EE–5B, 1000 Independence Avenue SW, Washington, DC 20585–0121. Email: *ApplianceStandardsQuestions@ee.doe.gov.*

Mr. Matthew Schneider, U.S. Department of Energy, Office of the General Counsel, GC–33, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (240) 597–6265. Email: *matthew.schneider@hq.doe.gov.*

For further information on how to submit a comment, review other public comments and the docket, or participate in the public meeting, contact the Appliance and Equipment Standards Program staff at (202) 287–1445 or by email: *ApplianceStandardsQuestions@ee.doe.gov.*

SUPPLEMENTARY INFORMATION:

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I. Synopsis of the Proposed Rule

The Energy Policy and Conservation Act, Public Law 94–163, as amended (''EPCA''),[1] authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. (42 U.S.C. 6291–6317) Title III, Part C of EPCA,[2] established the Energy Conservation Program for Certain Industrial Equipment. (42 U.S.C. 6311–6317) Such equipment includes walk-ins,[3] the subject of this rulemaking.

Pursuant to EPCA, any new or amended energy conservation standard must be designed to achieve the maximum improvement in energy efficiency that DOE determines is technologically feasible and economically justified. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(A)) Furthermore, the new or amended standard must result in a significant conservation of energy. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(3)(B)) EPCA also provides that not later than 6 years after issuance of any final rule establishing or amending a standard, DOE must publish either a notice of determination that standards for the product do not need to be amended, or a notice of proposed rulemaking including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6316(a); 42 U.S.C. 6295(m))

In accordance with these and other statutory provisions discussed in this document, DOE analyzed the benefits and burdens of three trial standard levels (''TSLs'') for walk-ins. The TSLs and their associated benefits and burdens are discussed in detail in sections V.A through V.C of this document. As discussed in section V.C of this document, DOE has tentatively determined that TSL 2 represents the maximum improvement in energy efficiency that is technologically feasible and economically justified. The proposed standards for walk-in non-display doors, which are expressed in maximum daily energy consumption in kilowatt-hours per day (''kWh/day''), are shown in Table I.1. These proposed standards, if adopted, would apply to all non-display doors of walk-ins listed in Table I.1 manufactured in, or imported into, the United States starting on the date 3 years after the publication of the final rule for this proposed rulemaking.

[1] All references to EPCA in this document refer to the statute as amended through the Energy Act of 2020, Public Law 116–260 (Dec. 27, 2020), which reflect the last statutory amendments that impact Parts A and A–1 of EPCA.

[2] For editorial reasons, upon codification in the U.S. Code, Part C was re-designated Part A–1.

[3] Walk-in coolers and walk-in freezers are defined as an enclosed storage space, including but not limited to panels, doors, and refrigeration systems, refrigerated to temperatures, respectively, above, and at or below 32 degrees Fahrenheit that can be walked into, and has a total chilled storage area of less than 3,000 square feet; however, the terms do not include products designed and marketed exclusively for medical, scientific, or research purposes. 10 CFR 431.302.

TABLE I.1—PROPOSED ENERGY CONSERVATION STANDARDS FOR WALK-IN NON-DISPLAY DOORS

[TSL 2]

Equipment class			Maximum daily energy consumption (kWh/day) *
Display/non-display	Opening mechanism	Temperature	
Non-Display	Manual	Medium	$0.01 \times A_{nd} + 0.25$
		Low	$0.06 \times A_{nd} + 1.32$
	Manual	Medium	$0.01 \times A_{nd} + 0.39$
		Low	$0.05 \times A_{nd} + 1.56$

* A_{nd} is the representative value of surface area of the non-display door as determined in accordance with the DOE test procedure at 10 CFR part 431, subpart R, appendix A and applicable sampling plans.

The proposed standards for walk-in refrigeration systems, which are expressed as annual walk-in energy factor 2 (''AWEF2'') in British thermal units per Watt-hour (''Btu/W-h''), are shown in Table I.2. These proposed standards, if adopted, would apply to all walk-in refrigeration systems listed in Table I.2 manufactured in, or imported into, the United States starting on the date 3 years after the publication of the final rule for this proposed rulemaking.

TABLE I.2—PROPOSED ENERGY CONSERVATION STANDARDS FOR WALK-IN REFRIGERATION SYSTEMS

[TSL 2]

Equipment class	Minimum AWEF2 (Btu/W-h) *
Dedicated Condensing System—High, Indoor, Non-Ducted with a Net Capacity (q_{net}) of:	
<7,000 Btu/h	$7.80E–04 \times q_{net} + 2.20$
≥7,000 Btu/h	7.66
Dedicated Condensing system—High, Outdoor, Non-Ducted with a Net Capacity (q_{net}) of:	
<7,000 Btu/h	$1.02E–03 \times q_{net} + 2.47$
≥7,000 Btu/h	9.62
Dedicated Condensing system—High, Indoor, Ducted with a Net Capacity (q_{net}) of:	
<7,000 Btu/h	$2.46E–04 \times q_{net} + 1.55$
≥7,000 Btu/h	3.27
Dedicated Condensing system—High, Outdoor, Ducted with a Net Capacity (q_{net}) of:	
<7,000 Btu/h	$3.76E–04 \times q_{net} + 1.78$
≥7,000 Btu/h	4.41
Dedicated Condensing unit and Matched Refrigeration System—Medium, Indoor with a Net Capacity (q_{net}) of:	
<8,000 Btu/h	5.58
≥8,000 Btu/h and <25,000 Btu/h	$3.00E–05 \times q_{net} + 5.34$
≥25,000 Btu/h	6.09
Dedicated Condensing unit and Matched Refrigeration System—Medium, Outdoor with a Net Capacity (q_{net}) of:	
<25,000 Btu/h	$2.13E–05 \times q_{net} + 7.15$
≥25,000 Btu/h	7.68
Dedicated Condensing unit and Matched Refrigeration System—Low, Indoor with a Net Capacity (q_{net}) of:	
<25,000 Btu/h	$2.50E–05 \times q_{net} + 2.36$
≥25,000 Btu/h and <54,000 Btu/h	$1.72E–06 \times q_{net} + 2.94$
≥54,000 Btu/h	3.03
Dedicated Condensing unit and Matched Refrigeration System—Low, Outdoor with a Net Capacity (q_{net}) of:	
<9,000 Btu/h	$9.83E–05 \times q_{net} + 2.63$
≥9,000 Btu/h and <25,000 Btu/h	$3.06E–05 \times q_{net} + 3.23$
≥25,000 Btu/h and <75,000 Btu/h	$4.96E–06 \times q_{net} + 3.88$
≥75,000 Btu/h	4.25
Single-Packaged Dedicated Condensing system—Medium, Indoor with a Net Capacity (q_{net}) of:	
<9,000 Btu/h	$9.86E–05 \times q_{net} + 4.91$
≥9,000 Btu/h	5.8
Single-Packaged Dedicated Condensing system—Medium, Outdoor with a Net Capacity (q_{net}) of:	
<9,000 Btu/h	$2.47E–04 \times q_{net} + 4.89$
≥9,000 Btu/h	7.11
Single-Packaged Dedicated Condensing system—Low, Indoor with a Net Capacity (q_{net}) of:	
<6,000 Btu/h	$8.00E–05 \times q_{net} + 1.8$
≥6,000 Btu/h	2.28
Single-Packaged Dedicated Condensing system—Low, Outdoor with a Net Capacity (q_{net}) of:	
<6,000 Btu/h	$1.63E–04 \times q_{net} + 1.8$
≥6,000 Btu/h	2.77
Unit Cooler—High Non-Ducted with a Net Capacity (q_{net}) of:	
<9,000 Btu/h	10.34
≥9,000 Btu/h and <25,000 Btu/h	$3.83E–04 \times q_{net} + 6.9$
≥25,000 Btu/h	16.46
Unit Cooler—High Ducted with a Net Capacity (q_{net}) of:	
<9,000 Btu/h	6.93
≥9,000 Btu/h and <25,000 Btu/h	$3.64E–04 \times q_{net} + 3.66$
≥25,000 Btu/h	12.76
Unit Cooler—Medium	9.65

TABLE I.2—PROPOSED ENERGY CONSERVATION STANDARDS FOR WALK-IN REFRIGERATION SYSTEMS—Continued

[TSL 2]

Equipment class	Minimum AWEF2 (Btu/W-h) *
Unit Cooler—Low	4.57

* q_{net} is the representative value of net capacity in Btu/h as determined in accordance with the DOE test procedure at 10 CFR part 431, subpart R, appendix C1 and applicable sampling plans.

A. Benefits and Costs to Consumers

Table I.3 through Table I.5 present DOE's evaluation of the economic impacts of the proposed standards on consumers of walk-ins, as measured by the average life-cycle cost (''LCC'') savings and the simple payback period (''PBP'').[4] The average LCC savings are positive for all equipment classes, and the PBP is less than the average lifetime of walk-ins, which is estimated to be between 8 and 20 years (see section IV.F.10 of this document).

TABLE I.3—IMPACTS OF PROPOSED ENERGY CONSERVATION STANDARDS ON CONSUMERS OF WALK-IN DISPLAY AND NON-DISPLAY DOORS

[TSL 2][5]

Display/non-display	Opening mechanism	Temperature	Average LCC savings (2022$)	Simple payback period (years)
Display	Manual	Low	....	....
		Medium	....	....
Non-Display	Manual	Low	723	1.3
		Medium	86	3.2
	Motorized	Low	1,192	1.0
		Medium	113	2.4

TABLE I.4—IMPACTS OF PROPOSED ENERGY CONSERVATION STANDARDS ON CONSUMERS OF WALK-IN PANELS

[TSL 2]

Equipment	Temperature	Average LCC savings (2022$)	Simple payback period (years)
Structural	Low	....	....
	Medium	....	....
Floor	Low	....	....

TABLE I.5—IMPACTS OF PROPOSED ENERGY CONSERVATION STANDARDS ON CONSUMERS OF WALK-IN REFRIGERATION SYSTEMS

[TSL 2]

System	Temperature	Location	Average LCC savings (2022$)	Simple payback period (years)
Dedicated Condensing Unit and Matched Refrigeration System.	Low	Indoor	163	4.0
		Outdoor	172	3.6
	Medium	Indoor	567	3.4
		Outdoor	136	2.6
Unit Cooler	Low	N/A	1,306	1.2
	Medium		212	2.0
	High		....	....
	High, Ducted		237	0.7
Matched Refrigeration Systems and Single-Packaged Dedicated Systems.	High, Non-Ducted	Indoor	124	1.3
		Outdoor	126	2.9
	High, Ducted	Indoor	296	1.7
		Outdoor	305	3.4

[4] The average LCC savings refer to consumers that are affected by a standard and are measured relative to the efficiency distribution in the no-new-standards case, which depicts the market in the compliance year in the absence of new or amended standards (see section IV.F.9 of this document). The simple PBP, which is designed to compare specific efficiency levels, is measured relative to the baseline product (see section IV.F of this document).

[5] All monetary values in this document are expressed in 2022 dollars.

TABLE I.5—IMPACTS OF PROPOSED ENERGY CONSERVATION STANDARDS ON CONSUMERS OF WALK-IN REFRIGERATION SYSTEMS—Continued

[TSL 2]

System	Temperature	Location	Average LCC savings (2022$)	Simple payback period (years)
Single-Packaged Dedicated Systems	Low	Indoor	180	3.8
		Outdoor	....	....
	Medium	Indoor	103	3.5
		Outdoor	177	1.2

DOE's analysis of the impacts of the proposed standards on consumers is described in section IV.F of this document.

B. Impact on Manufacturers [6]

The industry net present value (''INPV'') is the sum of the discounted cash flows to the industry from the base year through the end of the analysis period (2023–2056). Using a real discount rate of 9.4 percent for doors, 10.5 percent for panels, and 10.2 percent for refrigeration systems, DOE estimates that the INPV for manufacturers of walk-in display doors, non-display doors, panels, and refrigeration systems in the case without amended standards is $278.0 million, $536.7 million, $875.2 million, and $490.1 million, respectively. Under the proposed standards, all walk-in display door equipment classes remain at the baseline efficiency level. As a result, there are no changes to INPV and no conversion costs for display door manufacturers. Under the proposed standards, the change in INPV for non-display door manufacturers is estimated to range from −4.8 percent to −2.6 percent, which is approximately −$25.5 million to −$14.2 million. Under the proposed standards, all walk-in panel equipment classes remain at the baseline efficiency level. As a result, there are no changes to INPV and no conversion costs for panel manufacturers. Under the proposed standards, the change in INPV for refrigeration system manufacturers is estimated to range from −9.8 percent to −7.7 percent, which is approximately −$47.8 million to −$37.9 million. In order to bring equipment into compliance with amended standards, it is estimated that the walk-in non-display door and refrigeration system industries would incur total conversion costs of $28.9 million and $60.1 million, respectively.

DOE's analysis of the impacts of the proposed standards on manufacturers is described in section IV.J of this document. The analytic results of the manufacturer impact analysis (''MIA'') are presented in section V.B.2 of this document.

C. National Benefits and Costs

DOE's analyses indicate that the proposed energy conservation standards for walk-ins would save a significant amount of energy. Relative to the case without amended standards, the lifetime energy savings for walk-ins purchased in the 30-year period that begins in the anticipated year of compliance with the amended standards (2027–2056) amount to 1.51 quadrillion British thermal units (''Btu''), or quads.[7] This represents a savings of 6 percent relative to the energy use of these products in the case without amended standards (referred to as the ''no-new-standards case'').

The cumulative net present value (''NPV'') of total consumer benefits of the proposed standards for walk-ins ranges from $1.45 billion (at a 7-percent discount rate) to $3.66 billion (at a 3-percent discount rate). This NPV expresses the estimated total value of future operating-cost savings minus the estimated increased product costs and installation costs for walk-ins purchased in 2027–2056.

In addition, the proposed standards for walk-ins are projected to yield significant environmental benefits. DOE estimates that the proposed standards would result in cumulative emission reductions (over the same period as for energy savings) of 28.5 million metric tons (''Mt'') [8] of carbon dioxide (''CO_2''), 8.8 thousand tons of sulfur dioxide (''SO_2''), 52.9 thousand tons of nitrogen oxides (''NO_X''), 237.4 thousand tons of methane (''CH_4''), 0.3 thousand tons of nitrous oxide (''N_2O''), and 0.1 tons of mercury (''Hg'').[9]

DOE estimates the value of climate benefits from a reduction in greenhouse gases (GHG) using four different estimates of the social cost of CO_2 (''SC–CO_2''), the social cost of methane (''SC–CH_4''), and the social cost of nitrous oxide (''SC–N_2O''). Together these represent the social cost of GHG (''SC–GHG''). DOE used interim SC–GHG values (in terms of benefit per ton of GHG avoided) developed by an Interagency Working Group on the Social Cost of Greenhouse Gases (''IWG'').[10] The derivation of these values is discussed in section IV.L of this document. For presentational purposes, the climate benefits associated with the average SC–GHG at a 3-percent discount rate are estimated to be $1.6 billion. DOE does not have a single central SC–GHG point estimate and it emphasizes the importance and value of considering the benefits calculated using all four sets of SC–GHG estimates.

DOE estimated the monetary health benefits of SO_2 and NO_X emissions reductions using benefit-per-ton estimates from the Environmental Protection Agency,[11] as discussed in

[6] All monetary values in this document are expressed in 2022 dollars unless otherwise noted.

[7] The quantity refers to full-fuel-cycle (''FFC'') energy savings. FFC energy savings includes the energy consumed in extracting, processing, and transporting primary fuels (*i.e.,* coal, natural gas, petroleum fuels), and, thus, presents a more complete picture of the impacts of energy efficiency standards. For more information on the FFC metric, see section IV.H.2 of this document.

[8] A metric ton is equivalent to 1.1 short tons. Results for emissions other than CO_2 are presented in short tons.

[9] DOE calculated emissions reductions relative to the no-new-standards-case, which reflects key assumptions in the *Annual Energy Outlook 2023* (''*AEO2023*''). *AEO2023* reflects, to the extent possible, laws and regulations adopted through mid-November 2022, including the Inflation Reduction Act. See section IV.K of this document for further discussion of *AEO2023* assumptions that effect air pollutant emissions.

[10] To monetize the benefits of reducing GHG emissions this analysis uses the interim estimates presented in the Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990 published in February 2021 by the IWG. (''February 2021 SC–GHG TSD''). *www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.*

[11] U.S. EPA. Estimating the Benefit per Ton of Reducing Directly Emitted $PM_{2.5}$, $PM_{2.5}$ Precursors and Ozone Precursors from 21 Sectors. Available at

section IV.L of this document. DOE estimated the present value of the health benefits would be $1.3 billion using a 7-percent discount rate, and $3.2 billion using a 3-percent discount rate.[12] DOE is currently only monetizing health benefits from changes in ambient fine particulate matter ($PM_{2.5}$) concentrations from two precursors (SO_2 and NO_X), and from changes in ambient ozone from one precursor (for NO_X), but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions.

Table I.6 summarizes the monetized benefits and costs expected to result from the proposed standards for walk-ins. There are other important unquantified effects, including certain unquantified climate benefits, unquantified public health benefits from the reduction of toxic air pollutants and other emissions, unquantified energy security benefits, and distributional effects, among others.

TABLE I.6—SUMMARY OF MONETIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR WALK-INS

[TSL 2]

	Billion 2022$
3% discount rate	
Consumer Operating Cost Savings	4.7
Climate Benefits *	1.6
Health Benefits **	3.2
Total Benefits †	9.5
Consumer Incremental Product Costs ‡	1.3
Net Benefits	8.2
Change in Producer Cashflow (INPV ‡‡)	(0.07) − (0.05)
7% discount rate	
Consumer Operating Cost Savings	2.2
Climate Benefits * (3% discount rate)	1.6
Health Benefits **	1.3
Total Benefits †	5.1
Consumer Incremental Product Costs ‡	0.7
Net Benefits	4.4
Change in Producer Cashflow (INPV ‡‡)	(0.07) − (0.05)

Note: This table presents the costs and benefits associated with walk-in coolers and freezers shipped in 2027–2056. These results include consumer, climate, and health benefits that accrue after 2056 from the walk-in coolers and freezers shipped in 2027–2056.

* Climate benefits are calculated using four different estimates of the social cost of carbon ($SC–CO_2$), methane ($SC–CH_4$), and nitrous oxide ($SC–N_2O$) (model average at 2.5 percent, 3 percent, and 5 percent discount rates; 95th percentile at 3 percent discount rate) (see section IV.L of this document). Together these represent the global SC–GHG. For presentational purposes of this table, the climate benefits associated with the average SC–GHG at a 3 percent discount rate are shown; however, DOE emphasizes the importance and value of considering the benefits calculated using all four sets of SC–GHG estimates. To monetize the benefits of reducing GHG emissions, this analysis uses the interim estimates presented in the *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990* published in February 2021 by the IWG.

** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. DOE is currently only monetizing (for SO_2 and NO_X) $PM_{2.5}$ precursor health benefits and (for NO_X) ozone precursor health benefits, but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions. See section IV.L of this document for more details.

† Total and net benefits include those consumer, climate, and health benefits that can be quantified and monetized. For presentation purposes, total and net benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate.

‡ Costs include incremental equipment costs as well as installation costs.

‡‡ Operating Cost Savings are calculated based on the life cycle costs analysis and national impact analysis as discussed in detail. See sections IV.F and IV.H of this document. DOE's NIA includes all impacts (both costs and benefits) along the distribution chain beginning with the increased costs to the manufacturer to manufacture the equipment and ending with the increase in price experienced by the consumer. DOE also separately conducts a detailed analysis on the impacts on manufacturers (the MIA). See section IV.J of this document. In the detailed MIA, DOE models manufacturers' pricing decisions based on assumptions regarding investments, conversion costs, cashflow, and margins. The MIA produces a range of impacts, which is the rule's expected impact on the INPV. The change in INPV is the present value of all changes in industry cash flow, including changes in production costs, capital expenditures, and manufacturer profit margins. Change in INPV is calculated using the industry weighted average cost of capital values of 9.4 percent for walk-in non-display doors and 10.2 percent for walk-in refrigeration systems that are estimated in the MIA (see chapter 12 of the NOPR TSD for a complete description of the industry weighted average cost of capital). For walk-ins, those values are −$73 million to −$52 million. DOE accounts for that range of likely impacts in analyzing whether a TSL is economically justified. See section V.C of this document. DOE is presenting the range of impacts to the INPV under two markup scenarios: the Preservation of Gross Margin scenario, which is the manufacturer markup scenario used in the calculation of Consumer Operating Cost Savings in this table, and the Preservation of Operating Profit Markup scenario, where DOE assumed manufacturers would not be able to increase per-unit operating profit in proportion to increases in manufacturer production costs. DOE includes the range of estimated INPV in the above table, drawing on the MIA explained further in section IV.J of this document, to provide additional context for assessing the estimated impacts of this proposal to society, including potential changes in production and consumption, which is consistent with OMB's Circular A–4 and E.O. 12866. If DOE were to include the INPV into the net benefit calculation for this proposed rule, the net benefits would range from $8.13 billion to $8.15 billion at 3-percent discount rate and would range from $4.33 billion to $4.35 billion at 7-percent discount rate. Parentheses ( ) indicate negative values. DOE seeks comment on this approach.

www.epa.gov/benmap/estimating-benefit-ton-reducing-pm25-precursors-21-sectors.

[12] DOE estimates the economic value of these emissions reductions resulting from the considered TSLs for the purpose of complying with the requirements of Executive Order 12866.

The benefits and costs of the proposed standards can also be expressed in terms of annualized values. The monetary values for the total annualized net benefits are (1) the reduced consumer operating costs, minus (2) the increase in product purchase prices and installation costs, plus (3) the value of climate and health benefits of emission reductions, all annualized.[13]

The national operating cost savings are domestic private U.S. consumer monetary savings that occur as a result of purchasing the covered products and are measured for the lifetime of walk-ins shipped in 2027–2056. The benefits associated with reduced emissions achieved as a result of the proposed standards are also calculated based on the lifetime of walk-ins shipped in 2027–2056. Total benefits for both the 3-percent and 7-percent cases are presented using the average GHG social costs with 3-percent discount rate. Estimates of SC–GHG values are presented for all four discount rates in section IV.L of this document.

Table I.7 presents the total estimated monetized benefits and costs associated with the proposed standard, expressed in terms of annualized values. The results under the primary estimate are as follows.

Using a 7-percent discount rate for consumer benefits and costs and health benefits from reduced NOx and SO_2 emissions, and the 3-percent discount rate case for climate benefits from reduced GHG emissions, the estimated cost of the standards proposed in this rule is $70.7 million per year in increased equipment costs, while the estimated annual benefits are $214.1 million in reduced equipment operating costs, $90.4 million in climate benefits, and $132.2 million in health benefits. In this case the net benefit would amount to $366.0 million per year.

Using a 3-percent discount rate for all benefits and costs, the estimated cost of the proposed standards is $72.4 million per year in increased equipment costs, while the estimated annual benefits are $260.0 million in reduced operating costs, $90.4 million in climate benefits, and $177.7 million in health benefits. In this case, the net benefit would amount to $455.7 million per year.

TABLE I.7—ANNUALIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR WALK-INS

[TSL 2]

	Million 2022$/year		
	Primary estimate	Low-net-benefits estimate	High-net-benefits estimate
3% discount rate			
Consumer Operating Cost Savings	260.0	265.3	264.9
Climate Benefits *	90.4	92.6	90.0
Health Benefits **	177.7	182.1	177.0
Total Monetized Benefits †	528.1	540.0	531.9
Consumer Incremental Product Costs ‡	72.4	102.6	64.7
Monetized Net Benefits	455.7	437.4	467.2
Change in Producer Cashflow (INPV‡‡)	(7.6) − (5.4)	(7.6) − (5.4)	(7.6) − (5.4)
7% discount rate			
Consumer Operating Cost Savings	214.1	218.8	218.3
Climate Benefits * (3% discount rate)	90.4	92.6	90.0
Health Benefits **	132.2	135.3	131.7
Total Monetized Benefits †	436.7	446.7	440.0
Consumer Incremental Product Costs ‡	70.7	95.4	64.1
Monetized Net Benefits	366.0	351.2	376.0
Change in Producer Cashflow (INPV ‡‡)	(7.6) − (5.4)	(7.6) − (5.4)	(7.6) − (5.4)

Note: This table presents the costs and benefits associated with walk-ins shipped in 2027–2056. These results include consumer, climate, and health benefits that accrue after 2056 from the products shipped in 2027–2056. The Primary, Low Net Benefits, and High Net Benefits Estimates utilize projections of energy prices from the AEO2023 Reference case, Low Economic Growth case, and High Economic Growth case, respectively. In addition, incremental equipment costs reflect a medium decline rate in the Primary Estimate, a low decline rate in the Low Net Benefits Estimate, and a high decline rate in the High Net Benefits Estimate. The methods used to derive projected price trends are explained in sections IV.F.1 and IV.H.3 of this document. Note that the Benefits and Costs may not sum to the Net Benefits due to rounding.

* Climate benefits are calculated using four different estimates of the global SC–GHG (see section IV.L of this document). For presentational purposes of this table, the climate benefits associated with the average SC–GHG at a 3 percent discount rate are shown; however, DOE emphasizes the importance and value of considering the benefits calculated using all four sets of SC–GHG estimates. To monetize the benefits of reducing GHG emissions, this analysis uses the interim estimates presented in the *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990* published in February 2021 by the IWG.

** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. DOE is currently only monetizing (for SO_2 and NO_X) $PM_{2.5}$ precursor health benefits and (for NO_X) ozone precursor health benefits, but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions. See section IV.L of this document for more details.

† Total benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate.

‡ Costs include incremental equipment costs as well as installation costs.

[13] To convert the time-series of costs and benefits into annualized values, DOE calculated a present value in 2023, the year used for discounting the NPV of total consumer costs and savings. For the benefits, DOE calculated a present value associated with each year's shipments in the year in which the shipments occur (*e.g.,* 2030), and then discounted the present value from each year to 2023. Using the present value, DOE then calculated the fixed annual payment over a 30-year period, starting in the compliance year, that yields the same present value.

‡‡ Operating Cost Savings are calculated based on the life cycle costs analysis and national impact analysis as discussed in detail below. See sections IV.F and IV.H of this document. DOE's NIA includes all impacts (both costs and benefits) along the distribution chain beginning with the increased costs to the manufacturer to manufacture the product and ending with the increase in price experienced by the consumer. DOE also separately conducts a detailed analysis on the impacts on manufacturers (the MIA). See section IV.J of this document. In the detailed MIA, DOE models manufacturers' pricing decisions based on assumptions regarding investments, conversion costs, cashflow, and margins. The MIA produces a range of impacts, which is the rule's expected impact on the INPV. The change in INPV is the present value of all changes in industry cash flow, including changes in production costs, capital expenditures, and manufacturer profit margins. The annualized change in INPV is calculated using the industry weighted average cost of capital values of 9.4 percent for walk-in non-display doors and 10.2 percent for walk-in refrigeration systems that are estimated in the MIA (see chapter 12 of the NOPR TSD for a complete description of the industry weighted average cost of capital). For walk-ins, those values are −$7.6 million to −$5.4 million. DOE accounts for that range of likely impacts in analyzing whether a TSL is economically justified. See section V.C of this document. DOE is presenting the range of impacts to the INPV under two markup scenarios: the Preservation of Gross Margin scenario, which is the manufacturer markup scenario used in the calculation of Consumer Operating Cost Savings in this table, and the Preservation of Operating Profit Markup scenario, where DOE assumed manufacturers would not be able to increase per-unit operating profit in proportion to increases in manufacturer production costs. DOE includes the range of estimated annualized change in INPV in the above table, drawing on the MIA explained further in section IV.J of this document, to provide additional context for assessing the estimated impacts of this proposal to society, including potential changes in production and consumption, which is consistent with OMB's Circular A–4 and E.O. 12866. If DOE were to include the INPV into the annualized net benefit calculation for this proposed rule, the annualized net benefits would range from $448.1 million to $450.3 million at 3-percent discount rate and would range from $358.4 million to $360.6 million at 7-percent discount rate. Parentheses ( ) indicate negative values. DOE seeks comment on this approach.

DOE's analysis of the national impacts of the proposed standards is described in sections IV.H, IV.K and IV.L of this document.

D. Conclusion

DOE has tentatively concluded that the proposed standards represent the maximum improvement in energy efficiency that is technologically feasible and economically justified, and would result in the significant conservation of energy. Specifically, with regards to technological feasibility, equipment achieving these standard levels are already commercially available for all equipment classes covered by this proposal. As for economic justification, DOE's analysis shows that the benefits of the proposed standard exceed, to a great extent, the burdens of the proposed standards.

Using a 7-percent discount rate for consumer benefits and costs and NOx and SO_2 reduction benefits, and a 3-percent discount rate case for GHG social costs, the estimated cost of the proposed standards for walk-ins is $70.7 million per year in increased equipment costs, while the estimated annual benefits are $214.1 million in reduced equipment operating costs, $90.4 million in climate benefits and $132.2 million in health benefits. The net benefit amounts to $366.0 million per year.

The significance of the savings offered by a new or amended energy conservation standard cannot be determined without knowledge of the specific circumstances surrounding a given rulemaking.[14] For example, some covered products and equipment have substantial energy consumption occur during periods of peak energy demand. The impacts of these products on the energy infrastructure can be more pronounced than products with relatively constant demand. Accordingly, DOE evaluates the significance of energy savings on a case-by-case basis.

As previously mentioned, the standards are projected to result in estimated national energy savings of 1.55 quad FFC for walk-in doors, panels and refrigeration systems shipped between 2027 and 2056, the equivalent of the primary annual energy use of 42.7 million homes, or 1.4 million homes per year of the analysis. In addition, they are projected to reduce CO_2 emissions by 28.5 Mt for walk-in doors, panels and refrigeration systems shipped between 2027 and 2056.[15] Based on these findings, DOE has initially determined the energy savings from the proposed standard levels are ''significant'' within the meaning of 42 U.S.C. 6295(o)(3)(B). A more detailed discussion of the basis for these tentative conclusions is contained in the remainder of this document and the accompanying technical support document (''TSD'').

DOE also considered more-stringent energy efficiency levels as potential standards, and is still considering them in this rulemaking. However, DOE has tentatively concluded that the potential burdens of the more-stringent energy efficiency levels would outweigh the projected benefits.

Based on consideration of the public comments DOE receives in response to this document and related information collected and analyzed during the course of this rulemaking effort, DOE may adopt energy efficiency levels presented in this document that are either higher or lower than the proposed standards, or some combination of level(s) that incorporate the proposed standards in part.

II. Introduction

The following section briefly discusses the statutory authority underlying this proposed rule, as well as some of the relevant historical background related to the establishment of standards for walk-ins.

A. Authority

EPCA authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment.

Title III, Part C of EPCA, added by Public Law 95–619, Title IV, section 441(a) (42 U.S.C. 6311–6317, as codified), established the Energy Conservation Program for Certain Industrial Equipment, which sets forth a variety of provisions designed to improve energy efficiency. This equipment includes walk-ins, the subject of this document. (42 U.S.C. 6311(1)(G)) EPCA prescribed initial standards for these products. (42 U.S.C. 6313(f)) EPCA specifically prescribed that no later than January 1, 2020, the Secretary shall publish a final rule to determine if the standards should be amended. (42 U.S.C. 6313(f)(5)) EPCA further provides that, not later than 6 years after the issuance of any final rule establishing or amending a standard, DOE must publish either a notice of determination that standards for the product do not need to be amended, or a NOPR including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6316(a); 42 U.S.C. 6295(m)(1)).

The energy conservation program under EPCA consists essentially of four parts: (1) testing, (2) labeling, (3) the establishment of Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA include definitions (42 U.S.C. 6311), test procedures (42 U.S.C. 6314), labeling provisions (42 U.S.C. 6315), energy conservation standards (42

[14] Procedures, Interpretations, and Policies for Consideration in New or Revised Energy Conservation Standards and Test Procedures for Consumer Products and Commercial/Industrial Equipment, 86 FR 70892, 70901 (Dec. 13, 2021).

[15] These results include benefits to consumers which accrue after 2056 from the equipment shipped in 2027–2056.

U.S.C. 6313), and the authority to require information and reports from manufacturers (42 U.S.C. 6316; 42 U.S.C. 6296).

Federal energy efficiency requirements for covered equipment established under EPCA generally supersede State laws and regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6316(a) and (b); 42 U.S.C. 6297) DOE may, however, grant waivers of Federal preemption for particular State laws or regulations, in accordance with the procedures and other provisions set forth under EPCA. (See 42 U.S.C. 6316(a) (applying the preemption waiver provisions of 42 U.S.C. 6297))

Subject to certain criteria and conditions, DOE is required to develop test procedures to measure the energy efficiency, energy use, or estimated annual operating cost of each covered equipment during a representative average use cycle and that are not unduly burdensome to conduct. (42 U.S.C. 6314(a)(2)) Manufacturers of covered equipment must use the Federal test procedures as the basis for: (1) certifying to DOE that their equipment complies with the applicable energy conservation standards adopted pursuant to EPCA (42 U.S.C. 6316(a); 42 U.S.C. 6295(s)), and (2) making representations about the efficiency of that equipment (42 U.S.C. 6314(d)). Similarly, DOE must use these test procedures to determine whether the equipment complies with relevant standards promulgated under EPCA. (42 U.S.C. 6316(a); 42 U.S.C. 6295(s)) The DOE test procedures for walk-ins appear at title 10 of the Code of Federal Regulations (''CFR'') part 431, subpart R, appendices A, B, C, and C1.

DOE must follow specific statutory criteria for prescribing new or amended standards for covered equipment, including walk-ins. Any new or amended standard for a covered product must be designed to achieve the maximum improvement in energy efficiency that the Secretary of Energy determines is technologically feasible and economically justified. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(A)) Furthermore, DOE may not adopt any standard that would not result in the significant conservation of energy. (42 U.S.C. 6295(o)(3))

Moreover, DOE may not prescribe a standard: (1) for certain products, including walk-ins, if no test procedure has been established for the product, or (2) if DOE determines by rule that the standard is not technologically feasible or economically justified. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(3)(A)–(B)) In deciding whether a proposed standard is economically justified, DOE must determine whether the benefits of the standard exceed its burdens. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(B)(i)) DOE must make this determination after receiving comments on the proposed standard, and by considering, to the greatest extent practicable, the following seven statutory factors:

(1) The economic impact of the standard on manufacturers and consumers of the products subject to the standard;

(2) The savings in operating costs throughout the estimated average life of the covered products in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses for the covered products that are likely to result from the standard;

(3) The total projected amount of energy (or as applicable, water) savings likely to result directly from the standard;

(4) Any lessening of the utility or the performance of the covered products likely to result from the standard;

(5) The impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from the standard;

(6) The need for national energy and water conservation; and

(7) Other factors the Secretary of Energy (''Secretary'') considers relevant. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(B)(i)(I)–(VII))

Further, EPCA establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the energy savings during the first year that the consumer will receive as a result of the standard, as calculated under the applicable test procedure. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(B)(iii))

EPCA also contains what is known as an ''anti-backsliding'' provision, which prevents the Secretary from prescribing any amended standard that either increases the maximum allowable energy use or decreases the minimum required energy efficiency of a covered product. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(1)) Also, the Secretary may not prescribe an amended or new standard if interested persons have established by a preponderance of the evidence that the standard is likely to result in the unavailability in the United States in any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(4))

Additionally, EPCA specifies requirements when promulgating an energy conservation standard for a covered product that has two or more subcategories. DOE must specify a different standard level for a type or class of product that has the same function or intended use, if DOE determines that products within such group: (A) consume a different kind of energy from that consumed by other covered products within such type (or class); or (B) have a capacity or other performance-related feature which other products within such type (or class) do not have and such feature justifies a higher or lower standard. (42 U.S.C. 6316(a); 42 U.S.C. 6295(q)(1)) In determining whether a performance-related feature justifies a different standard for a group of products, DOE must consider such factors as the utility to the consumer of the feature and other factors DOE deems appropriate. *Id.* Any rule prescribing such a standard must include an explanation of the basis on which such higher or lower level was established. (42 U.S.C. 6316(a); 42 U.S.C. 6295(q)(2))

B. Background

1. Current Standards

The current energy conservation standards for walk-ins are set forth in DOE's regulations at 10 CFR 431.306. The current energy conservation standards for walk-in doors are in terms of maximum daily energy consumption, which is measured in kWh/day (see Table II.1). The current energy conservation standards for walk-in panels are in terms of R-value, which is measured in h-ft²-°F/Btu (see Table II.2). The current energy conservation standards for refrigeration systems are in terms of AWEF, which is measured in Btu/W-h (see Table II.3).

TABLE II.1—FEDERAL ENERGY CONSERVATION STANDARDS FOR WALK-IN COOLERS AND WALK-IN FREEZER DOORS

Equipment class	Equations for maximum daily energy consumption (kWh/day)
Display door, medium-temperature.	$0.04 \times A_{dd} + 0.41$.
Display door, low-temperature.	$0.15 \times A_{dd} + 0.29$.
Passage door, medium-temperature.	$0.05 \times A_{nd} + 1.7$.
Passage door, low-temperature.	$0.14 \times A_{nd} + 4.8$.

TABLE II.1—FEDERAL ENERGY CONSERVATION STANDARDS FOR WALK-IN COOLERS AND WALK-IN FREEZER DOORS—Continued

Equipment class	Equations for maximum daily energy consumption (kWh/day)
Freight door, medium-temperature.	$0.04 \times A_{nd} + 1.9$.
Freight door, low-temperature	$0.12 \times A_{nd} + 5.6$.

A_{dd} or A_{nd} = surface area of the display door or non-display door, respectively, expressed in ft^2, as determined in appendix A to subpart R of 10 CFR part 431.

TABLE II.2—FEDERAL ENERGY CONSERVATION STANDARDS FOR WALK-IN COOLERS AND WALK-IN FREEZER PANELS

Equipment class	Minimum R-value (h-ft^2-°F/Btu)
Wall or ceiling panels, medium-temperature	25
Wall or ceiling panels, low-temperature	32
Floor panels, low-temperature	28

TABLE II.3—FEDERAL ENERGY CONSERVATION STANDARDS FOR WALK-IN COOLERS AND WALK-IN FREEZER REFRIGERATION SYSTEMS

Equipment class	Minimum AWEF (Btu/W-h)
Dedicated condensing system, medium-temperature, indoor	5.61.
Dedicated condensing system, medium-temperature, outdoor	7.60.
Dedicated condensing system, low-temperature, indoor with a net capacity (q_{net}) of <6,500 British thermal units per hour (''Btu/h'').	$9.091 \times 10^{5} \times q_{net} + 1.81$.
Dedicated condensing system, low-temperature, indoor with a net capacity (q_{net}) of ≥6,500 Btu/h.	2.40.
Dedicated condensing system, low-temperature, outdoor with a net capacity (q_{net}) of <6,500 Btu/h.	$6.522 \times 10^{-5} \times q_{net} + 2.73$.
Dedicated condensing system, low-temperature, outdoor with a net capacity (q_{net}) of ≥6,500 Btu/h.	3.15.
Unit cooler, medium-temperature	9.00.
Unit cooler, low-temperature, indoor with a net capacity (q_{net}) of <15,500 Btu/h	$1.575 \times 10^{-5} \times q_{net} + 3.91$.
Unit cooler, low-temperature, indoor with a net capacity (q_{net}) of ≥15,500 Btu/h	4.15.
Where q_{net} is net capacity as determined in accordance with 10 CFR 431.304 and certified in accordance with 10 CFR part 429.	

2. History of Standards Rulemaking for Walk-Ins

In a final rule published on June 3, 2014 (''June 2014 Final Rule''), DOE prescribed the energy conservation standards for walk-in doors, panels, and refrigeration systems manufactured on and after June 5, 2017. 79 FR 32050. After publication of the June 2014 Final Rule, the Air-Conditioning, Heating and Refrigeration Institute (''AHRI'') and Lennox International, Inc. (''Lennox''), a manufacturer of walk-in refrigeration systems, filed petitions for review of DOE's final rule and DOE's subsequent denial of a petition for reconsideration of the rule (79 FR 59090 (October 1, 2014)) with the United States Court of Appeals for the Fifth Circuit. *Lennox Int'l* v. *Dep't of Energy,* Case No. 14–60535 (5th Cir.). A settlement agreement was reached among the parties under which the Fifth Circuit vacated energy conservation standards for six of the refrigeration system equipment classes—the two standards applicable to multiplex condensing refrigeration systems (subsequently re-named as ''unit coolers'') operating at medium and low-temperatures and the four standards applicable to dedicated condensing refrigeration systems operating at low-temperatures.[16] After the Fifth Circuit issued its order, DOE established a Working Group to negotiate energy conservation standards to replace the six vacated standards. 80 FR 46521 (August 5, 2015). The Working Group assembled its recommendations into a Term Sheet (see Docket EERE–2015–BT–STD–0016–0056) that was presented to, and approved by, the Appliance Standards and Rulemaking Federal Advisory Committee on December 18, 2015. (EERE–2015–BT–STD–0016–0055 at p. 11)

In a final rule published on July 10, 2017 (''July 2017 Final Rule''), DOE adopted energy conservation standards for the six classes of walk-in refrigeration systems were vacated—specifically, unit coolers and low-temperature dedicated condensing systems. 82 FR 31808. The rule required compliance with the six new standards on and after July 10, 2020.

To evaluate whether to propose amendments to the energy conservation standards for walk-ins, DOE issued a request for information (''RFI'') in the **Federal Register** on July 16, 2021 (''July 2021 RFI''). 86 FR 37687. In the July 2021 RFI, DOE sought data, information, and comment pertaining to walk-ins. 86 FR 37687, 37689.

DOE subsequently announced the availability of the preliminary analysis it had conducted for the purpose of evaluating the need for amending the current energy conservation standards for walk-ins in the **Federal Register** on June 30, 2022, (''June 2022 Preliminary Analysis''). The analysis was set forth in the Department's accompanying preliminary TSD. DOE held a public meeting via webinar to discuss and receive comment on the June 2022 Preliminary Analysis on July 22, 2022. The meeting covered the analytical framework, models, and tools that DOE

[16] The 13 other standards established in the June 2014 Final Rule (*i.e.,* the four standards applicable to dedicated condensing refrigeration systems operating at medium temperatures; the three standards applicable to panels; and the six standards applicable to doors) were not vacated. The compliance date for the remaining standards was on or after June 5, 2017.

used to evaluate potential standards; the results of the preliminary analyses performed by DOE; the potential energy conservation standard levels derived from those analyses; and other relevant issues.

In response to the publication of the July 2021 RFI, DOE received comments from interested parties. The July 2021 RFI comments were addressed in chapter 2 of the June 2022 Preliminary Analysis TSD.

DOE received comments in response to the June 2022 Preliminary Analysis from the interested parties listed in Table II.4 of this document.

TABLE II.4—JUNE 2022 PRELIMINARY ANALYSIS WRITTEN COMMENTS

Commenter(s)	Abbreviation	Comment No. in the docket	Commenter type
Air-Conditioning, Heating, and Refrigeration Institute	AHRI [17]	39	Trade Association.
Air-Conditioning, Heating, and Refrigeration Institute	AHRI-Wine [18]	39	Trade Association.
Appliance Standards Awareness Project, American Council for an Energy-Efficient Economy, Natural Resources Defense Council, Northwest Energy Efficiency Alliance.	Efficiency Advocates	37	Efficiency Organizations.
Heat Transfer Products Group, LLC	HTPG	35	Manufacturer.
Hussmann Corporation	Hussmann—Door	33	Manufacturer.
Hussmann Corporation	Hussmann—Refrigeration	38	Manufacturer.
KeepRite Refrigeration, Inc	KeepRite	41	Manufacturer.
Lennox International Inc	Lennox	36	Manufacturer.
North American Association of Food Equipment	NAFEM	42	Trade Association.
Rob Brooks	Brooks	34	Individual.

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[19] To the extent that interested parties have provided written comments that are substantively consistent with any oral comments provided during the July 22, 2022, public meeting, DOE cites the written comments throughout this document. Any oral comments provided during the webinar that are not substantively addressed by written comments are summarized and cited separately throughout this document.

C. Deviation From Process Rule

In accordance with section 3(a) of 10 CFR part 430, subpart C, appendix A (''Process Rule''), DOE notes that it is deviating from the provision in the Process Rule regarding the pre-NOPR and NOPR stages for an energy conservation standard rulemaking by not publishing a framework document and providing a public comment period less than 75 days. Framework Document

Section 6(a)(2) of the Process Rule states that if DOE determines it is appropriate to proceed with a rulemaking, the preliminary stages of a rulemaking to issue or amend an energy conservation standard that DOE will undertake will be a framework document and preliminary analysis, or an advance notice of proposed rulemaking. While DOE published a preliminary analysis for this rulemaking (*see* 87 FR 39008), DOE did not publish a framework document in conjunction with the preliminary analysis. DOE notes, however, that chapter 2 of the preliminary TSD that accompanied the preliminary analysis—entitled *Analytical Framework, Comments from Interested Parties, and DOE Responses*—describes the general analytical framework that DOE uses in evaluating and developing potential amended energy conservation standards.[20] As such, publication of a separate framework document would be largely redundant of previously published documents.

1. Public Comment Period

Section 6(f)(2) of the Process Rule specifies that the length of the public comment period for a NOPR will be not less than 75 calendar days. For this NOPR, DOE is instead providing a 60-day comment period, consistent with EPCA requirements. 42 U.S.C. 6316(a); 42 U.S.C. 6295(p). DOE is opting to deviate from the 75-day comment period because stakeholders have already been afforded multiple opportunities to provide comments on this proposed rulemaking.

As noted previously, DOE requested comment in the July 2021 RFI on the analysis conducted in support of the last energy conservation standard rulemaking for walk-ins and provided a 30-day comment period. In its June 2022 Preliminary Analysis and TSD, DOE's analysis remained largely the same as the analysis conducted in support of the previous energy conservation standards rulemaking for walk-ins. DOE requested comment in the June 2022 Preliminary Analysis TSD on the analysis conducted in support of this current rulemaking. Given that this analysis remained largely the same as the June 2022 Preliminary Analysis, and in light of the 60-day comment period DOE has already provided with its June 2022 Preliminary Analysis, DOE has determined that a 60-day comment period is appropriate for this NOPR and that it will provide interested parties with a meaningful opportunity to comment on the proposed rule.

III. General Discussion

DOE developed this proposal after considering oral and written comments, data, and information from interested parties that represent a variety of interests. The following discussion addresses issues raised by these commenters.

[17] AHRI submitted two comment documents to the docket. The first document in the docket includes AHRI's comments for traditional walk-in manufacturers (*i.e.,* medium- and low-temperature walk-in components). The associated file name in the docket is: AHRI Comments WICF NOPR EERE–2017–BT–STD–0009. These comments are referenced in this document as ''AHRI'' comments.

[18] AHRI submitted two comment documents to the docket. The second document in the docket includes AHRI's comments supporting wine cellar manufacturers (*i.e.,* high-temperature walk-in refrigeration systems). The associated file name in the docket is: Comments WICF NOPR EERE–2017–BT–STD–0009 Wine. These comments are referenced in this document as ''AHRI-Wine'' comments.

[19] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to develop energy conservation standards for walk-ins. (Docket NO. EERE–2017–BT–STD–0009, which is maintained at *www.regulations.gov*). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

[20] The preliminary technical support document is available at *www.regulations.gov/document/EERE-2017-BT-STD-0009-0024*.

A. General Comments

This section summarizes general comments received from interested parties regarding rulemaking timing and process.

The Efficiency Advocates commented that they encourage DOE to consider evaluating potential standards for refrigeration shipping containers. (Efficiency Advocates, No. 37 at pp. 5–6) As discussed in the test procedure final rule that was published on May 4, 2023 (''May 2023 TP Final Rule''), DOE has not evaluated refrigerated shipping containers to determine if current walk-in test procedures would produce test results that reflect energy efficiency, energy use, or estimated operating costs during a representative average use cycle, without being unduly burdensome to conduct. 88 FR 28780, 28787. Therefore, DOE has determined that refrigerated shipping containers are not currently subject to the DOE test procedure or energy conservation standards for WICFs. DOE may consider whether test procedures and energy conservation standards should be applied to refrigerated shipping containers in a future rulemaking.

AHRI-Wine commented that wine cellar manufacturers seek clarification on whether the June 2022 Preliminary Analysis would change AWEF standards for high-temperature walk-in refrigeration systems. (AHRI-Wine, No. 39 at p. 5) DOE notes that there are currently no standards for high-temperature units. DOE did analyze high-temperature units in the June 2022 Preliminary Analysis. In this NOPR, DOE is proposing an energy conservation standard for high-temperature units in section I.

AHRI-Wine urged DOE to increase in future analysis the box load multiplier of 0.5 that was proposed in the April 2022 test procedure because many wine cellar applications are high-end homes with little traffic into and out of the cellar. (AHRI-Wine, No. 39 at p. 3) DOE notes that the box load multiplier is part of the walk-in test procedure and not the energy conservation standards. The May 2023 TP Final Rule adopted the box load multiplier of 0.5 and therefore, the NOPR engineering analysis for high-temperature units used this value.

AHRI-Wine recommended that DOE conduct interviews with more wine cellar manufacturers to get a better representation of the wine cellar market. (AHRI, No. 39 at p. 5) DOE notes that it invited several wine cellar manufacturers to participate in interviews, which informed this rulemaking. DOE further notes that it welcomes comments, data, and information regarding this proposed rule from all interested parties.

The Efficiency Advocates suggested that DOE consider setting standards for refrigeration systems as a function of capacity since larger capacity units are generally able to reach higher efficiency levels. (Efficiency Advocates, No. 37 at pp. 2–3) Furthermore, the Efficiency Advocates cited the disparity in the LCC to support setting standards as a function of capacity. *Id.* DOE evaluated the economics of each efficiency level for each representative unit. This analysis indicated that more stringent standards were generally economically justified for larger units and, therefore, DOE proposed standards that reflected this. As seen in section I, DOE is proposing standards as a function of capacity for most refrigeration system equipment classes.

Lennox commented that several items were non-functional in the June 2022 preliminary engineering analysis worksheet. (Lennox, No. 36 at p. 9) DOE notes that a new engineering spreadsheet has been updated to reflect the updated analysis for this NOPR and the items identified by Lennox have been resolved in this version of the engineering sheet.[21] Additionally, DOE has reviewed the non-functional items identified in Lennox's comment and found that none impacted the results of the engineering analysis.

NAFEM stated that it endorses and reiterates all comments made by AHRI. (NAFEM, No. 42 at p. 2) DOE notes that throughout this document, reference to comments made by AHRI are therefore understood to be representative of the viewpoints of NAFEM as well. NAFEM also commented that it hopes DOE will follow the Process Rule. *Id.* In section II.C of this document, DOE discusses certain minor deviations from the Process Rule as well as the justification for such deviations. Aside from these minor deviations, DOE has developed this NOPR in accordance with the Process Rule.

B. Scope of Coverage

This NOPR covers ''walk-in coolers and walk-in freezers'' defined as an enclosed storage space, including but not limited to panels, doors, and refrigeration systems, refrigerated to temperatures, respectively, above, and at or below 32 degrees Fahrenheit that can be walked into, and has a total chilled storage area of less than 3,000 square feet; however, the terms do not include products designed and marketed exclusively for medical, scientific, or research purposes. 10 CFR 431.302. Rather than establishing standards for complete walk-in systems, DOE has established standards for the principal components that make up a walk-in (*i.e.,* doors, panels, and refrigeration systems).

A ''door'' means an assembly installed in an opening on an interior or exterior wall that is used to allow access or close off the opening and that is movable in a sliding, pivoting, hinged, or revolving manner of movement. For walk-in coolers and walk-in freezers, a door includes the frame (including mullions), the door leaf or multiple leaves (including glass) within the frame, and any other elements that form the assembly or part of its connection to the wall. *Id.*

A ''panel'' means a construction component that is not a door and is used to construct the envelope of the walk-in, (*i.e.,* elements that separate the interior refrigerated environment of the walk-in from the exterior). *Id.*

A ''refrigeration system'' means the mechanism (including all controls and other components integral to the system's operation) used to create the refrigerated environment in the interior of a walk-in cooler or walk-in freezer, consisting of:

(1) A dedicated condensing refrigeration system (as defined in 10 CFR 431.302); or

(2) A unit cooler.

The scope of coverage and equipment classes for this NOPR are discussed in further detail in section IV.A.1 of this document.

C. Test Procedure

EPCA sets forth generally applicable criteria and procedures for DOE's adoption and amendment of test procedures. (42 U.S.C. 6314(a)) Manufacturers of covered equipment must use these test procedures to certify to DOE that their equipment complies with energy conservation standards and to quantify the efficiency of their equipment. DOE's current energy conservation standards for walk-in doors are expressed in terms of maximum daily energy consumption, DOE's current energy conservation standards for walk-in panels are expressed in terms of R-value, and DOE's current energy conservation standards for walk-in refrigeration systems are expressed in terms of AWEF. (See 10 CFR part 431, subpart R, appendices A, B, C, and C1.)

On April 21, 2022, DOE published a test procedure NOPR (''April 2022 TP NOPR'') and on May 4, 2023, DOE published the May 2023 TP Final Rule.

[21] The new refrigeration systems engineering sheet can be found at *www.regulations.gov/docket/EERE-2017-BT-STD-0009.*

87 FR 23920; 88 FR 28780 In the June 2022 Preliminary Analysis, DOE used the test procedure proposed in the April 2022 TP NOPR to evaluate the efficiency of walk-in components. In this NOPR analysis, DOE used the test procedure adopted in the May 2023 TP Final Rule to evaluate the efficiency of walk-in components. From this point forward the May 2023 TP Final Rule will be the ''current test procedure''.

In the May 2023 TP Final Rule, DOE established a new appendix, appendix C1 to subpart R (''appendix C1''), and a new energy metric, AWEF2, for refrigeration systems. (*See* 10 CFR part 431, subpart R, appendix C1.) The engineering analysis results and the proposed energy conservation standards for refrigeration systems are presented as AWEF2 values. Manufacturers would be required to begin using appendix C1 as of the compliance date of an energy conservation standards promulgated as a result of this rulemaking.

D. Technological Feasibility

1. General

In each energy conservation standards rulemaking, DOE conducts a screening analysis based on information gathered on all current technology options and prototype designs that could improve the efficiency of the equipment that are the subject of the rulemaking. As the first step in such an analysis, DOE develops a list of technology options for consideration in consultation with manufacturers, design engineers, and other interested parties. DOE then determines which of those means for improving efficiency are technologically feasible. DOE considers technologies incorporated in commercially available equipment or in working prototypes to be technologically feasible. 10 CFR 431.4; 10 CFR part 430, subpart C, appendix A, sections 6(b)(3)(i) and 7(b)(1) of the Process Rule.

After DOE has determined that particular technology options are technologically feasible, it further evaluates each technology option in light of the following additional screening criteria: (1) practicability to manufacture, install, and service; (2) adverse impacts on equipment utility or availability; (3) adverse impacts on health or safety, and (4) unique-pathway proprietary technologies. 10 CFR 431.4; Sections 6(b)(3)(ii)–(v) and 7(b)(2)–(5) of the Process Rule. Section IV.B of this document discusses the results of the screening analysis for walk-in doors, panels, and refrigeration systems, particularly the designs DOE considered, those it screened out, and those that are the basis for the standards considered in this rulemaking. For further details on the screening analysis for this rulemaking, see chapter 4 of the NOPR TSD.

2. Maximum Technologically Feasible Levels

When DOE proposes to adopt a new or amended standard for a type or class of covered product, it must determine the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible for such equipment. (42 U.S.C. 6316(a); 42 U.S.C. 6295(p)(1)) Accordingly, in the engineering analysis, DOE determined the maximum technologically feasible (''max-tech'') improvements in energy efficiency for walk-in doors, panels, and refrigeration systems, using the design parameters for the most efficient equipment available on the market or in working prototypes. The max-tech levels that DOE determined for this rulemaking are described in section IV.C.1 of this proposed rule and in chapter 5 of the NOPR TSD.

E. Energy Savings

1. Determination of Savings

For each trial standard level (''TSL''), DOE projected energy savings from application of the TSL to walk-in doors, panels, and refrigeration systems purchased in the 30-year period that begins in the year of compliance with the proposed standards (2027–2056).[22] The savings are measured over the entire lifetime of walk-in doors, panels, and refrigeration systems purchased in the previous 30-year period. DOE quantified the energy savings attributable to each TSL as the difference in energy consumption between each standards case and the no-new-standards case. The no-new-standards case represents a projection of energy consumption that reflects how the market for the equipment would likely evolve in the absence of amended energy conservation standards.

DOE used its national impact analysis (''NIA'') spreadsheet model to estimate national energy savings (''NES'') from potential amended or new standards for walk-in doors, panels, and refrigeration systems. The NIA spreadsheet model (described in section IV.H of this document) calculates energy savings in terms of site energy, which is the energy directly consumed by products at the locations where they are used. For electricity, DOE reports national energy savings in terms of primary energy savings, which is the savings in the energy that is used to generate and transmit the site electricity. DOE also calculates NES in terms of FFC energy savings. The FFC metric includes the energy consumed in extracting, processing, and transporting primary fuels (*i.e.,* coal, natural gas, petroleum fuels), and thus presents a more complete picture of the impacts of energy conservation standards.[23] DOE's approach is based on the calculation of an FFC multiplier for each of the energy types used by covered products or equipment. For more information on FFC energy savings, see section IV.H.2 of this document.

2. Significance of Savings

To adopt any new or amended standards for covered equipment, DOE must determine that such action would result in significant energy savings. (42 U.S.C. 6295(o)(3)(B))

The significance of energy savings offered by a new or amended energy conservation standard cannot be determined without knowledge of the specific circumstances surrounding a given rulemaking.[24] For example, some covered equipment have most of their energy consumption occur during periods of peak energy demand. The impacts of this equipment on the energy infrastructure can be more pronounced than equipment with relatively constant demand. Accordingly, DOE evaluates the significance of energy savings on a case-by-case basis, taking into account the significance of cumulative FFC national energy savings, the cumulative FFC emissions reductions, and the need to confront the global climate crisis, among other factors. DOE has initially determined the energy savings from the proposed standard levels are ''significant'' within the meaning of 42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(3)(B).

As stated, the standard levels proposed in this document are projected to result in national energy savings of 1.55 quads, the equivalent of the primary annual energy use of 42.7 million homes. Based on the amount of FFC savings, the corresponding reduction in emissions, and the need to confront the global climate crisis, DOE

[22] Each TSL is composed of specific efficiency levels for each equipment class. The TSLs considered for this NOPR are described in section V.A of this document. DOE conducted a sensitivity analysis that considers impacts for products shipped in a 9-year period.

[23] The FFC metric is discussed in DOE's statement of policy and notice of policy amendment. 76 FR 51282 (Aug. 18, 2011), as amended at 77 FR 49701 (Aug. 17, 2012).

[24] The numeric threshold for determining the significance of energy savings established in a final rule published on February 14, 2020 (85 FR 8626, 8670), was subsequently eliminated in a final rule published on December 13, 2021 (86 FR 70892).

has initially determined the energy savings from the proposed standard levels are ''significant'' within the meaning of 42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(3)(B).

F. Economic Justification

1. Specific Criteria

As noted previously, EPCA provides seven factors to be evaluated in determining whether a potential energy conservation standard is economically justified. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(B)(i)(I)–(VII)) The following sections discuss how DOE has addressed each of those seven factors in this rulemaking.

a. Economic Impact on Manufacturers and Consumers

In determining the impacts of a potential new or amended standard on manufacturers, DOE conducts an MIA, as discussed in section IV.J of this document. DOE first uses an annual cash flow approach to determine the quantitative impacts. This step includes both a short-term assessment—based on the cost and capital requirements during the period between when a regulation is issued and when entities must comply with the regulation—and a long-term assessment over a 30-year period. The industry-wide impacts analyzed include (1) INPV, which values the industry on the basis of expected future cash flows, (2) cash flows by year, (3) changes in revenue and income, and (4) other measures of impact, as appropriate. Second, DOE analyzes and reports the impacts on different types of manufacturers, including impacts on small manufacturers. Third, DOE considers the impact of standards on domestic manufacturer employment and manufacturing capacity, as well as the potential for standards to result in plant closures and loss of capital investment. Finally, DOE takes into account cumulative impacts of various DOE regulations and other regulatory requirements on manufacturers.

For individual consumers, measures of economic impact include the changes in LCC and PBP associated with new or amended standards. These measures are discussed further in the following section. For consumers in the aggregate, DOE also calculates the national net present value of the consumer costs and benefits expected to result from particular standards. DOE also evaluates the impacts of potential standards on identifiable subgroups of consumers that may be affected disproportionately by a standard.

b. Savings in Operating Costs Compared to Increase in Price (LCC and PBP)

EPCA requires DOE to consider the savings in operating costs throughout the estimated average life of the covered equipment in the type (or class) compared to any increase in the price of, or in the initial charges for, or maintenance expenses of, the covered equipment that are likely to result from a standard. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(B)(i)(II)) DOE conducts this comparison in its LCC and PBP analysis.

The LCC is the sum of the purchase price of equipment (including its installation) and the operating expense (including energy, maintenance, and repair expenditures) discounted over the lifetime of the equipment. The LCC analysis requires a variety of inputs, such as equipment prices, equipment energy consumption, energy prices, maintenance and repair costs, equipment lifetime, and discount rates appropriate for consumers. To account for uncertainty and variability in specific inputs, such as equipment lifetime and discount rate, DOE uses a distribution of values, with probabilities attached to each value.

The PBP is the estimated amount of time (in years) it takes consumers to recover the increased purchase cost (including installation) of more-efficient equipment through lower operating costs. DOE calculates the PBP by dividing the change in purchase cost due to a more-stringent standard by the change in annual operating cost for the year that standards are assumed to take effect.

For its LCC and PBP analysis, DOE assumes that consumers will purchase the covered equipment in the first year of compliance with new or amended standards. The LCC savings for the considered efficiency levels are calculated relative to the case that reflects projected market trends in the absence of new or amended standards. DOE's LCC and PBP analysis is discussed in further detail in section IV.F of this document.

c. Energy Savings

Although significant conservation of energy is a separate statutory requirement for adopting an energy conservation standard, EPCA requires DOE, in determining the economic justification of a standard, to consider the total projected energy savings that are expected to result directly from the standard. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(B)(i)(III)) As discussed in section III.E of this document, DOE uses its NIA model to project national energy savings.

d. Lessening of Utility or Performance of Equipment

In establishing equipment classes and in evaluating design options and the impact of potential standard levels, DOE evaluates potential standards that would not lessen the utility or performance of the considered equipment. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(B)(i)(IV)) Based on data available to DOE, the standards proposed in this document would not reduce the utility or performance of the equipment under consideration in this rulemaking.

e. Impact of Any Lessening of Competition

EPCA directs DOE to consider the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from a proposed standard. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(B)(i)(V)) It also directs the Attorney General to determine the impact, if any, of any lessening of competition likely to result from a proposed standard and to transmit such determination to the Secretary within 60 days of the publication of a proposed rule, together with an analysis of the nature and extent of the impact. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(B)(ii)) DOE will transmit a copy of this proposed rule to the Attorney General with a request that the Department of Justice (''DOJ'') provide its determination on this issue. DOE will publish and respond to the Attorney General's determination in the final rule. DOE invites comment from the public regarding the competitive impacts that are likely to result from this proposed rule. In addition, stakeholders may also provide comments separately to DOJ regarding these potential impacts. See the **ADDRESSES** section for information to send comments to DOJ.

f. Need for National Energy Conservation

DOE also considers the need for national energy and water conservation in determining whether a new or amended standard is economically justified. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(B)(i)(VI)) The energy savings from the proposed standards are likely to provide improvements to the security and reliability of the Nation's energy system. Reductions in the demand for electricity also may result in reduced costs for maintaining the reliability of the Nation's electricity system. DOE conducts a utility impact analysis to estimate how standards may affect the Nation's needed power generation capacity, as discussed in section IV.M of this document.

DOE maintains that environmental and public health benefits associated with the more efficient use of energy are important to take into account when considering the need for national energy conservation. The proposed standards are likely to result in environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases (''GHGs'') associated with energy production and use. DOE conducts an emissions analysis to estimate how potential standards may affect these emissions, as discussed in section IV.K of this document; the estimated emissions impacts are reported in section V.B.6 of this document. DOE also estimates the economic value of emissions reductions resulting from the considered TSLs, as discussed in section V.C.1 of this document.

g. Other Factors

In determining whether an energy conservation standard is economically justified, DOE may consider any other factors that the Secretary deems to be relevant (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(B)(i)(VII)) To the extent DOE identifies any relevant information regarding economic justification that does not fit into the other categories described previously, DOE could consider such information under ''other factors.''

2. Rebuttable Presumption

EPCA creates a rebuttable presumption that an energy conservation standard is economically justified if the additional cost to the equipment that meets the standard is less than three times the value of the first year's energy savings resulting from the standard, as calculated under the applicable DOE test procedure. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(B)(iii)) DOE's LCC and PBP analyses generate values used to calculate the effects that proposed energy conservation standards would have on the payback period for consumers. These analyses include, but are not limited to, the 3-year payback period contemplated under the rebuttable-presumption test. In addition, DOE routinely conducts an economic analysis that considers the full range of impacts to consumers, manufacturers, the Nation, and the environment, as required under 42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(B)(i). The results of this analysis serve as the basis for DOE's evaluation of the economic justification for a potential standard level (thereby supporting or rebutting the results of any preliminary determination of economic justification). The rebuttable presumption payback calculation is discussed in section V.B.1.c of this proposed rule.

IV. Methodology and Discussion of Related Comments

This section addresses the analyses DOE has performed for this rulemaking with regard to walk-ins. Separate subsections address each component of DOE's analyses.

DOE used several analytical tools to estimate the impact of the standards proposed in this document. The first tool is a spreadsheet that calculates the LCC savings and PBP of potential amended or new energy conservation standards. The national impacts analysis uses a second spreadsheet set that provides shipments projections and calculates national energy savings and net present value of total consumer costs and savings expected to result from potential energy conservation standards. DOE uses the third spreadsheet tool, the Government Regulatory Impact Model (''GRIM''), to assess manufacturer impacts of potential standards. These three spreadsheet tools are available on the DOE website for this proposed rulemaking: *www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=56&action=viewlive.* Additionally, DOE used output from the latest version of the Energy Information Administration's (''EIA's'') *Annual Energy Outlook* (''*AEO*''), a widely known energy projection for the United States, for the emissions and utility impact analyses.

A. Market and Technology Assessment

DOE develops information in the market and technology assessment that provides an overall picture of the market for the equipment concerned, including the purpose of the equipment, the industry structure, manufacturers, market characteristics, and technologies used in the equipment. This activity includes both quantitative and qualitative assessments, based primarily on publicly available information. The subjects addressed in the market and technology assessment for this rulemaking include (1) a determination of the scope of the rulemaking and equipment classes, (2) manufacturers and industry structure, (3) existing efficiency programs, (4) shipments information, (5) market and industry trends; and (6) technologies or design options that could improve the energy efficiency of walk-ins. The key findings of DOE's market assessment are summarized in the following sections. See chapter 3 of the NOPR TSD for further discussion of the market and technology assessment.

1. Equipment Classes

When evaluating and establishing energy conservation standards, DOE may establish separate standards for a group of covered equipment (*i.e.,* establish a separate equipment class) if DOE determines that separate standards are justified based on the type of energy used, or if DOE determines that equipment capacity or other performance-related feature justifies a different standard. (42 U.S.C. 6316(a); 42 U.S.C. 6295(q)) In making a determination whether a performance-related feature justifies a different standard, DOE must consider such factors as the utility of the feature to the consumer and other factors DOE determines are appropriate. (*Id.*)

Rather than establishing standards for complete walk-in systems, DOE has established standards for each of the principal components that make up a walk-in (*i.e.,* doors, panels, and refrigeration systems).

a. Doors

DOE's existing standards for walk-in doors are based on six equipment classes, differentiated by temperature and whether they are display doors or non-display doors. DOE defines a display door as a door that is designed for product display or has 75 percent or more of its surface area composed of glass or another transparent material. 10 CFR 431.302. Non-display doors are all doors not considered display doors and are mainly used to allow people and products to be moved into and out of the walk-in. Non-display doors are further divided by whether they are passage or freight doors. DOE defines a freight door as a door that is not a display door and is equal to or larger than 4 feet wide and 8 feet tall. DOE defines passage doors as any doors that are not display doors or freights doors. *Id.* Display, passage, and freight doors are further divided based on walk-in temperature (*i.e.,* cooler or freezer). DOE currently defines separate energy conservation standards for the following walk-in door classes (10 CFR 431.306(c) and (d)):

- Display Door, Medium-temperature,
- Display Door, Low-temperature,
- Passage Door, Medium-temperature,
- Passage Door, Low-temperature,
- Freight Door, Medium-temperature, and
- Freight Door, Low-temperature.

In the June 2022 Preliminary Analysis, DOE combined passage and freight non-display door classes and instead differentiated non-display doors by whether or not they have motorized door openers. DOE's initial research and analysis indicated that distinguishing non-display door classes by the presence or absence of a motorized door opener could be a more appropriate distinction of equipment classes rather than door size. As with its prior analysis, DOE also evaluated the motorized and non-motorized non-display door classes by temperature conditions: medium-temperature (*i.e.,* cooler) and low-temperature (*i.e.,* freezer).

In the June 2022 Preliminary Analysis, DOE also distinguished display door classes by the presence or absence of a motorized door opener. DOE analyzed medium- and low-temperature display doors without motorized door openers and medium-temperature display doors with motorized door openers. DOE has not identified any motorized display doors for low-temperature applications and therefore did not analyze such equipment in the June 2022 Preliminary Analysis. See section 3.1.2.1 of chapter 3 of the June 2022 preliminary analysis TSD.

DOE sought feedback on the equipment classes analyzed for walk-in doors in section ES.4.1 of the June 2022 Preliminary Analysis TSD. Hussmann-Doors commented that their request to have their Heavy Duty Door (''HDD'') and ABC Beer Cave (''ABC'') products classified as passage doors was not approved in 2017 and stated that there would be a cost benefit if their HDD and ABC product were to be classified as passage doors rather than display doors. Hussmann-Doors further elaborated that if these products were recognized as passage doors, they would not need to use expensive vacuum-insulated glass packs and could consider a more economical glass pack. (Hussmann-Doors, No. 33 at p. 2) In response, DOE notes that the display door definition references the physical characteristics of the door (*i.e.,* the percentage of surface area composed of glass or another transparent material) and is not contingent on door application. It is DOE's understanding that both Hussmann's HDD and ABC products are composed of at least 75 percent glass or another transparent material. Any door(s) that meets this criteria is considered a display door, even those not necessarily designed for product display.

The Efficiency Advocates agreed that non-display doors should be differentiated by manual or motorized opening mechanism (Efficiency Advocates, No. 37 at pp. 1–2).

Consistent with stakeholder feedback, DOE has tentatively concluded that it is more appropriate to distinguish non-display doors by whether or not they have a motorized door opener, rather than by size. Additionally, DOE has tentatively concluded that it is appropriate to distinguish display doors by whether or not they have a motorized door opener. DOE is proposing to establish the equipment classes listed in Table IV.1 for walk-in doors.

TABLE IV.1—PROPOSED EQUIPMENT CLASSES FOR WALK-IN DOORS

Display/non-display	Opening mechanism	Temperature	Class code
Display	Manual	Medium	DW.M.
		Low	DW.L.
	Motorized	Medium	DS.M.
Non-display	Manual	Medium	NM.M.
		Low	NM.L.
	Motorized	Medium	NO.M.
		Low	NO.L.

DOE discusses representative units, baseline assumptions for representative unit efficiency, and design options analyzed at higher efficiency levels for walk-in display and non-display doors in sections IV.C.1.a and IV.C.1.b of this document, respectively. DOE notes that, consistent with its June 2022 Preliminary Analysis, it did not consider more efficient levels for the motorized display door class beyond the current maximum energy consumption (*i.e.,* baseline efficiency level) in this NOPR. In its review of the motorized display door market, DOE found that manufacturers are already implementing maximum technology design options, such as vacuum- insulated glass, to achieve the current maximum energy consumption standard since the motor consumes additional energy. DOE has not identified any energy-saving technology options for motorized display doors that were retained during the screening analysis, as discussed in sections IV.A.2.b and IV.B of this document. DOE received comments in response to the June 2022 Preliminary Analysis regarding efficiency of motorized (*i.e.,* sliding) display doors. These comments are addressed in section IV.C.1.a of this document.

b. Panels

DOE's existing standards for walk-in panels apply to three equipment classes that are differentiated by whether they are structural (also referred to as ''wall or ceiling panels'') or floor panels. Structural panels are further separated by temperature condition (*i.e.,* cooler or freezer). DOE's analysis for the June 2014 Final Rule determined that, unlike walk-in freezers, the majority of walk-in coolers have concrete floors and no insulated floor panels. Thus, DOE did not adopt insulation R-value standards for walk-in cooler floors. 79 FR 32050, 32067. DOE's re-evaluation of the market for this rulemaking suggests that the walk-in cooler floor panel market has not changed substantially since the June 2014 Final Rule. Therefore, DOE has excluded walk-in cooler floor panels from this proposed rulemaking.

DOE currently defines separate energy conservation standards for the following walk-in panel classes (10 CFR 431.306(a)):

- Structural Panel, Medium-Temperature,
- Structural Panel, Low-Temperature, and
- Floor Panel, Low-Temperature.

DOE has not established standards for display panels because they make up a small percentage of the panel market; therefore, standards would not result in significant energy savings without incurring disproportionate costs. 79 FR 32050, 32067. In the June 2022 Preliminary Analysis, DOE maintained the current panel equipment classes. See section 3.1.2.2 of chapter 3 of the June 2022 preliminary analysis TSD. In section ES.4.1 of the June 2022 Preliminary Analysis TSD, DOE requested comment on the equipment classes used in this analysis. DOE received no comment regarding panel equipment classes in response to the June 2022 Preliminary Analysis. As such, DOE is proposing to maintain its current equipment classes for walk-in panels. Table IV.2 summarizes the equipment classes for walk-in panels.

TABLE IV.2—EQUIPMENT CLASSES FOR WALK-IN PANELS

Component	Temperature	Class code
Structural Panel	Medium	PS.M.
	Low	PS.L.
Floor Panel	Low	PF.L.

c. Refrigeration Systems

DOE's existing standards for walk-in refrigeration systems apply to nine equipment classes, differentiated by whether they are unit coolers or dedicated condensing systems and by temperature (*i.e.,* whether they are a cooler or freezer). A ''dedicated condensing system'' means a dedicated condensing unit, a single-packaged dedicated system, or a matched refrigeration system. (*See* 10 CFR 431.302.) Dedicated condensing systems are further differentiated by their installation location (*i.e.,* indoor or outdoor). Low-temperature dedicated condensing systems and unit cooler equipment classes are further differentiated by net capacity. DOE currently defines separate energy conservation standards for the following walk-in refrigeration system classes (10 CFR 431.306(e)):

- Dedicated Condensing System, Medium-Temperature, Indoor,
- Dedicated Condensing System, Medium-Temperature, Outdoor,
- Dedicated Condensing System, Low-Temperature, Indoor, Net Capacity of less than 6,500 Btu/h,
- Dedicated Condensing System, Low-Temperature, Indoor, Net Capacity of greater than or equal to 6,500 Btu/h,
- Dedicated Condensing System, Low-Temperature, Outdoor, Net Capacity of less than 6,500 Btu/h,
- Dedicated Condensing System, Low-Temperature, Outdoor, Net Capacity of greater than or equal to 6,500 Btu/h,
- Unit Cooler, Medium-Temperature,
- Unit Cooler, Low-Temperature, Net Capacity of less than 15,500 Btu/h, and
- Unit Cooler, Low-Temperature, Net Capacity of greater than or equal to 15,500 Btu/h.

In the June 2022 Preliminary Analysis TSD, DOE noted that single-packaged dedicated systems, which are dedicated condensing systems with a combined condensing unit and unit cooler, were not evaluated separately from dedicated condensing units and matched refrigeration systems in the previous rulemaking. New test procedure provisions in appendix C1 require specific test methods for single-packaged dedicated systems that measure the inherent thermal losses of such systems. These thermal losses reduce the capacity and therefore the efficiency of single-packaged dedicated systems. For this reason, in the June Preliminary Analysis, DOE evaluated single-packaged dedicated systems separately from split dedicated condensing systems.[25] *See* section 3.1.2.3 of chapter 3 of the June 2022 preliminary analysis TSD.

In the May 2023 TP Final Rule, DOE defined a high-temperature refrigeration system as a walk-in refrigeration system that is not designed to operate below 45 °F. 88 FR 28780, 28789. High-temperature units are generally smaller capacity than medium-temperature units and therefore contain small-capacity compressors, which DOE has found to be less efficient. Additionally, some high-temperature units are sold in ducted configurations. Ducting adds flexibility to installation location and removes refrigeration equipment from the refrigerated storage space. Ducts also increase energy consumption due to the higher external static pressure imposed on the system's fans. In the June 2022 Preliminary Analysis, DOE evaluated high-temperature units and ducted units as separate equipment classes. The equipment classes that DOE analyzed in the June 2022 Preliminary Analysis are summarized in Table IV.3.

TABLE IV.3—WALK-IN REFRIGERATION SYSTEM EQUIPMENT CLASSES ANALYZED IN THE JUNE 2022 PRELIMINARY ANALYSIS

System	Temperature	Location	Class code
Dedicated Condensing Unit	Medium-Temperature	Outdoor	DC.M.O.
		Indoor	DC.M.I.
	Low-Temperature	Outdoor	DC.L.O.
		Indoor	DC.L.I.
Unit Cooler	High-Temperature	N/A	UC.H.
	Medium-Temperature		UC.M.
	Low-Temperature		UC.L.
Single-Packaged Dedicated System	High-Temperature (Non-ducted)	Outdoor	SPU.H.O.
		Indoor	SPU.H.I.
	High-Temperature (Ducted)	Outdoor	SPU.H.O.D.
		Indoor	SPU.H.I.D.
	Medium-Temperature	Outdoor	SPU.M.O.
		Indoor	SPU.M.I.
	Low-Temperature	Outdoor	SPU.L.O.
		Indoor	SPU.L.I.

[25] Split dedicated condensing systems or split systems refer to any dedicated condensing system that is made up of a unit cooler and a remote dedicated condensing unit. The systems are split because the unit cooler and dedicated condensing unit are not in the same package.

DOE requested comment on the equipment classes in section ES.4.1 of the Executive Summary of the June 2022 Preliminary Analysis TSD, repeated in Table IV.3. AHRI requested further clarification on DOE's reasoning for separating single-packaged dedicated systems and dedicated condensing systems. (AHRI, No. 39 at pp. 1–2) Hussmann-Refrigeration stated that it agrees with AHRI's inquiry. (Hussmann-Refrigeration, No. 38 at p. 2) HTPG commented that it disagrees with DOE separating single-packaged dedicated systems and dedicated condensing systems because a single-packaged dedicated system is essentially a matched pair and matched pairs have the same efficiency requirements as dedicated condensing systems. (HTPG, No. 35 at p. 3) Additionally, HTPG stated that if single-packaged dedicated systems are held to a lower standard than dedicated condensing systems and matched pairs, then consumers could purchase lower cost single-packaged dedicated systems at a lower efficiency level than dedicated condensing units and matched pairs. *Id.* The Efficiency Advocates encouraged DOE to ensure that efficiency standard levels for single-packaged dedicated systems are as stringent (*e.g.,* incorporate similar assumed design options) as efficiency standard levels for dedicated condensing units to prevent a shift in the market away from dedicated condensing units and towards single-packaged dedicated systems. (Efficiency Advocates, No. 37 at p. 5)

DOE clarifies that in Table IV.3, the dedicated condensing unit equipment class refers to all split systems. In general, DOE has separated packaged equipment from split systems as packaged equipment provides consumers with more options for space-constrained applications. But packaged refrigeration systems are inherently less efficient because manufacturers cannot employ the same technologies such as increased heat exchanger sizes without impacting the overall dimensions of the packaged system. In addition, packaged systems are constrained by their overall weight limitations of the equipment, which affects the technologies options that can be applied to the system. Packaged systems typically contain smaller heat exchangers and those heat exchangers have less faces for airflow to pass over impacting the overall heat transfer of the system. In addition, packaged systems have both the cold and hot sides connected within the packaged framework and the cold side is exposed to the outside, which increases the losses associated with the thermal loads. Overall, DOE has tentatively decided that packaged system and split system WICF refrigeration systems cannot be combined into the same product class because packaged systems provide consumers with more options for space-constrained applications and inherent differences in system design between packaged systems and split systems limit the efficiency of the former.

AHRI-Wine commented that it seeks clarification on where matched split systems are represented in Table 5.3.4 of the June 2022 Preliminary Analysis TSD, which lists the representative units chosen for the refrigeration system analysis. (AHRI-Wine, No. 39 at p. 2) Also, AHRI-Wine recommended adding high-temperature dedicated condensing [units] since leaving these out of the scope would be a competitive disadvantage for manufacturers that sell single-packaged dedicated systems and matched split systems. *Id.* Furthermore, AHRI-Wine commented that wine cellar manufacturers seek clarification on the classes that constitute matched split, ducted and non-ducted, and indoor and outdoor systems. (AHRI-Wine, No. 39 at p. 5)

DOE notes that it did not establish a test procedure for high-temperature dedicated condensing units tested alone in the May 2023 TP Final Rule; however, it did establish a test procedure for high-temperature matched refrigeration systems and single-packaged dedicated condensing systems. This decision is discussed in detail in the May 2023 TP Final Rule. 88 FR 28780, 28816–28817. As such, DOE did not analyze high-temperature dedicated condensing units in this NOPR analysis and therefore is not proposing to establish an equipment class for high-temperature dedicated condensing units. DOE is, however, proposing to establish an equipment class for both high-temperature matched refrigeration systems and high-temperature single-packaged dedicated condensing systems. For this NOPR, DOE evaluated high-temperature matched refrigeration systems and high-temperature single-packaged dedicated systems as a single equipment class since both are sold with a condenser and an evaporator that are matched for optimal performance. Furthermore, the temperature difference between the refrigerated and ambient spaces for high-temperature refrigeration systems is less than the temperature difference for medium- and low-temperature systems. Therefore, thermal losses have less impact for high-temperature systems. This means that the difference in performance between high-temperature matched refrigeration systems and high-temperature single-packaged dedicated systems is much less than the performance difference expected between medium- or low-temperature matched refrigeration systems and medium- or low-temperature single-packaged dedicated systems. Because of the expected similarity in performance, DOE has tentatively determined that a single class of equipment encompassing high-temperature matched refrigeration systems and single-packaged dedicated systems is appropriate. In its analysis of high-temperature refrigeration units, DOE focused on single-packaged dedicated systems since this is where most of the shipments are concentrated for the high-temperature market.

DOE is proposing to establish the following equipment classes for refrigeration systems, as presented in Table IV.4.

TABLE IV.4—PROPOSED EQUIPMENT CLASSES FOR WALK-IN REFRIGERATION SYSTEMS

System	Temperature	Location	Class code
Dedicated Condensing Units and Matched Refrigeration Systems.	Medium-Temperature	Outdoor	DC.M.O.
		Indoor	DC.M.I.
	Low-Temperature	Outdoor	DC.L.O.
		Indoor	DC.L.I.
Unit Cooler	High-Temperature (Non-Ducted)	N/A	UC.H.
	High-Temperature (Ducted)		UC.H.D.
	Medium-Temperature		UC.M.
	Low-Temperature		UC.L.
Matched Refrigeration Systems and Single-Packaged Dedicated Systems.	High-Temperature (Non-ducted)	Outdoor	SPU.H.O.
		Indoor	SPU.H.I.

TABLE IV.4—PROPOSED EQUIPMENT CLASSES FOR WALK-IN REFRIGERATION SYSTEMS—Continued

System	Temperature	Location	Class code
Single-Packaged Dedicated Systems	High-Temperature (Ducted)	Outdoor	SPU.H.O.D.
		Indoor	SPU.H.I.D.
	Medium-Temperature	Outdoor	SPU.M.O.
		Indoor	SPU.M.I.
	Low-Temperature	Outdoor	SPU.L.O.
		Indoor	SPU.L.I.

As discussed previously, the current DOE standards for walk-in refrigeration systems differentiate low-temperature dedicated condensing systems and unit coolers by net capacity. DOE understands that for split systems and single-packaged dedicated systems, lower capacity systems may have greater difficulty attaining higher efficiency levels than higher capacity systems since compressors for small-sized equipment are generally less efficient. Additionally, DOE has found through testing that lower capacity unit coolers tend to have reduced efficiency compared to higher capacity unit coolers. As discussed in section III.A of this document, DOE received comments on the June 2022 Preliminary Analysis suggesting that walk-in refrigeration system efficiency standards should vary with net capacity for walk-in refrigeration system equipment classes. In this NOPR, DOE evaluated multiple capacities in each equipment class to better ascertain the relationship between efficiency and net capacity. This is discussed in more detail in the Representative Units subsection of section IV.C.1.d of this document. In section I, DOE discusses the proposed standards for walk-in refrigeration systems.

2. Technology Options

DOE considered separate technology options for whole walk-ins, doors, and panels, and refrigeration systems.

a. Fully Assembled Walk-Ins

In the market analysis and technology assessment presented in Chapter 3 of the June 2022 preliminary analysis TSD, DOE identified seven technology options that would be expected to improve the efficiency of a fully assembled walk-in (*i.e.,* wall, ceiling and floor panels, door(s), and refrigeration system(s)) but would not apply specifically to any of the components analyzed in this rulemaking:

- Energy storage systems,
- Refrigeration system override,
- Automatic evaporator fan shut-off,
- Non-penetrative internal racks and shelving,
- Humidity sensors,
- Fiber optic natural lighting, and
- Heat reclaim valve.

DOE requested comment on the technology options in section ES.4.2 of the June 2022 Preliminary Analysis TSD. DOE received no comments on the technology options that might improve the efficiency of whole walk-ins. Therefore, DOE identified the same technology options for the NOPR analysis. DOE further discusses these technology options in chapter 3 of the NOPR TSD.

b. Doors and Panels

In the preliminary market analysis and technology assessment, DOE identified 15 technology options that would be expected to improve the efficiency of doors and/or panels, as measured by the DOE test procedure. These technology options are listed in Table IV.5.

TABLE IV.5—SUMMARY OF DOOR AND PANEL-RELATED TECHNOLOGY OPTIONS ANALYZED IN THE JUNE 2022 PRELIMINARY ANALYSIS

Technology options	Applicable component
Door gaskets	Doors.
Anti-sweat heater/freezer wire controls.	
Display and window glass system insulation performance.	
Non-electric, reduced, or no anti-sweat systems.	
Improved frame systems.	
Automatic door opening and closing systems.	
Occupancy sensors.	
High-efficiency lighting.	
Automatic insulation deployment systems.	Display Doors.
Infiltration-reducing devices or systems (*e.g.,* air curtains, strip curtains, vestibule entryways, revolving doors).	Non-display Doors.
Insulation thickness and material.	Non-display doors and panels.
Framing materials.	
Damage-sensing systems (*e.g.,* air and water infiltration sensors, heat flux sensors).	
Panel interface systems	Panels.

In response to the June 2022 Preliminary Analysis, Hussmann-Doors stated that its sliding doors are designed to utilize insulation from the box/cooler wall to minimize door anti-sweat heat power. (Hussmann-Doors, No. 33 at p. 3) Per Hussmann-Doors' recommendation, DOE is considering this as a technology option for walk-in doors. The screening of this technology option is discussed further in section IV.B.1.a.

DOE is considering the same technology options for doors and panels in this NOPR that it considered in the June 2022 Preliminary Analysis, as well as the sliding doors referenced the comment from Hussmann-Doors.

c. Refrigeration Systems

In the preliminary market analysis and technology assessment, DOE identified 16 technology options that would be expected to improve the efficiency of refrigeration systems:

- Improved evaporator and condenser fan blades,
- Improved evaporator and condenser coils,
- Evaporator fan control,
- Ambient sub-cooling,
- Higher-efficiency fan motors,
- Higher-efficiency compressors,
- Variable-speed compressors,
- Liquid suction heat exchanger,
- Adaptive defrost,
- Hot gas defrost,
- Floating head pressure,
- Condenser fan control,
- Economizer cooling,
- Crank case heater controls,
- Single-package thermal insulation, and
- Oil management systems.

DOE requested comment on the technology options in section ES.4.2 of the June 2022 Preliminary Analysis TSD. AHRI commented that there are many technology options on the market that may individually provide energy savings for refrigeration systems, however, these technologies would require significant modification to implement with current systems and once implemented, they may no longer provide significant energy savings, as they are contingent on other aspects of the system. (AHRI, No. 39 at p. 2)

DOE notes that it applies screening criteria to all potential technology options which is designed to eliminate technologies that are not suitable for further analysis as discussed in section IV.B and in Ch. 4 of the TSD. This includes analysis of the technological feasibility and practicability. DOE then conducts a full engineering analysis to weigh the costs and energy savings of each design option that remains after the screening analysis. The engineering analysis is discussed in section IV.C. This engineering analysis evaluates potential changes to other aspects of the system necessary to implement the option.

HTPG agreed that DOE has considered all the technology options available on the market for walk-in refrigeration systems that it is aware of. (HTPG, No. 35 at p. 4) AHRI-Wine commented that wine cellar manufacturers agree with the technologies that DOE has considered in its analysis. (AHRI-Wine, No. 39 at p. 2)

Based on comments received from stakeholders, DOE is considering the same technology options for walk-in refrigeration systems in this NOPR as were considered in the June 2022 Preliminary Analysis.

B. Screening Analysis

DOE uses the following five screening criteria to determine which technology options are suitable for further consideration in an energy conservation standards rulemaking:

1. Technological feasibility. Technologies that are not incorporated in commercial equipment or in commercially viable, existing prototypes will not be considered further.

2. Practicability to manufacture, install, and service. If it is determined that mass production of a technology in commercial equipment and reliable installation and servicing of the technology could not be achieved on the scale necessary to serve the relevant market at the time of the projected compliance date of the standard, then that technology will not be considered further.

3. Impacts on product utility. If a technology is determined to have a significant adverse impact on the utility of the equipment to subgroups of consumers or result in the unavailability of any covered equipment type with performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as equipment generally available in the United States at the time, it will not be considered further.

4. Safety of technologies. If it is determined that a technology would have significant adverse impacts on health or safety, it will not be considered further.

5. Unique-pathway proprietary technologies. If a technology has proprietary protection and represents a unique pathway to achieving a given efficiency level, it will not be considered further, due to the potential for monopolistic concerns. 10 CFR 431.4; 10 CFR part 430, subpart C, appendix A, sections 6(c)(3) and 7(b).

In summary, if DOE determines that a technology, or a combination of technologies, fails to meet one or more of the listed five criteria, it will be excluded from further consideration in the engineering analysis. The reasons for eliminating any technology are discussed in the following sections.

The subsequent sections include comments from interested parties pertinent to the screening criteria, DOE's evaluation of each technology option against the screening analysis criteria, and whether DOE determined that a technology option should be excluded (''screened out'') based on the screening criteria.

1. Screened Out Technologies

a. Fully Assembled Walk-Ins

In the June 2022 Preliminary Analysis, DOE screened out the following technology options under the tentative assumption that they would not affect rated energy consumption of the walk-in components as measured by the DOE test procedure. While these technologies may improve the energy efficiency of a fully assembled walk-in installed in the field, DOE's current walk-in test procedures are component-specific (*i.e.,* DOE does not have a test procedure for determining energy use of a fully assembled walk-in):

- Energy storage systems,
- Refrigeration system override,
- Automatic evaporator fan shut-off,
- Non-penetrative internal racks and shelving,
- Humidity sensors, and
- Heat reclaim valves.

See section 4.2.1 of the June 2022 Preliminary Analysis TSD.

Furthermore, in the June 2022 Preliminary Analysis, DOE screened out fiber optic natural lighting since it is not technologically feasible. DOE is not aware of any such systems currently manufactured and sold for walk-in operations.

DOE requested comment on the technologies that it had screened out in section ES.4.3 of the June 2022 Preliminary Analysis TSD. HTPG commented that it agrees that energy storage systems, refrigeration systems override, automatic evaporator fan shut-off, humidity sensors, and heat reclaim valves do not affect the rated energy consumption as measured under the walk-in test procedures. (HTPG, No. 359 at p. 4) Lennox supported DOE's conclusions and rationale for the screened out technologies. (Lennox, No. 36 at p. 3) AHRI-Wine stated that wine cellar manufacturers agree with the technologies screened in and out of the analysis. (AHRI-Wine, No. 39 at p. 2)

In its NOPR analysis, DOE has screened out all technology options for whole walk-ins for the same rationales as it did for the June 2022 Preliminary Analysis.

b. Doors and Panels

In the June 2022 Preliminary Analysis, DOE screened out the following technology options because any reduction in energy use would not be captured by the test procedure in appendix A to subpart R of 10 CFR part 431 (''appendix A'') and any increase in R-value would not be captured by the test procedure in appendix B to subpart R of 10 CFR part 431 (''appendix B''):

- Infiltration-reducing devices,
- Air and water infiltration sensors,
- Heat flux sensors, and
- Structural materials for panels.

Infiltration-reducing technologies could include door gaskets, automatic door opening and closing systems, air curtains, strip curtains, vestibule entryways, revolving doors, and panel interface systems. In the June 2022 Preliminary Analysis, DOE had tentatively determined that any potential energy savings from infiltration-reducing devices would not be captured because air infiltration is a characteristic of a fully assembled walk-in. The walk-in test procedures do not evaluate the energy use of the assembled walk-in box and instead evaluate the energy use of a single component (*i.e.,* door or panel); therefore, technologies that may improve energy efficiency of the full walk-in box were screened out.

Additionally, DOE preliminarily concluded that any potential energy savings from air and water infiltration sensors, heat flux sensors, and structural materials for panels would not be captured by either the appendix A or appendix B test procedures. Air and water infiltration sensors and heat flux sensors are technology options that would most benefit the end user for monitoring the continuing performance of walk-in components; however, the potential degradation captured by these sensors over the lifetime of a walk-in are not reflected in the current test procedure. Additionally, changes to panel structural materials are not captured in the test procedure since the current walk-in panels test procedure provides a method for determining the R-value of the panel insulation only. In other words, the overall R-value of the panel, including structural materials, is not captured by the current test procedure. Therefore, such technologies were screened out.

Furthermore, in the June 2022 Preliminary Analysis, DOE screened out the following technologies due to technological infeasibility since DOE was not able to find these technologies incorporated into either prototypes or commercially available walk-in doors or panels:

- Non-electric anti-sweat systems,
- Higher efficiency LEDs, and
- Automatic insulation deployment systems.

In the June 2022 Preliminary Analysis, DOE screened out panel and door insulation thicker than six inches because DOE received feedback during manufacturer interviews that it is not practicable to manufacture and install and it has adverse impacts on consumer utility. *See* section 4.3.2.4 of chapter 4 of the June 2022 Preliminary Analysis TSD. DOE preliminarily concluded that insulation thicker than six inches would be heavy, unwieldy, and would take up space that the consumer would otherwise use. Additionally, panels and non-display doors greater than six inches that use foam-in-place insulation would take an excessive amount of time to cure, impacting the practicability to manufacture, install, and service.

In section ES.4.1 of the June 2022 Preliminary Analysis, DOE requested comment on the technology options it had screened out for doors and panels. DOE received no comment on the screened out technologies for doors and panels. In this analysis, DOE is screening out the same technologies that it screened out in the June 2022 Preliminary Analysis, in addition to the eliminated anti-sweat heater system technology option.

Walk-in doors typically use anti-sweat heater wires to prevent (1) condensation from collecting on the glass, frame, or any other portion of the door, which can puddle and be hazardous to consumers, (2) glass from fogging, and (3) condensation that may lead to low-temperature doors freezing shut. The amount and rate of condensation on walk-in doors is dependent on the relative humidity surrounding the walk-in and the surface temperature of the door. To ensure the temperature of the door surface stays above the dew point of its surroundings, electric resistive heater wire is installed around the frame of the door. DOE recognizes that anti-sweat systems on doors may be necessary in high-humidity environments and DOE does not have sufficient evidence to demonstrate that anti-sweat heat can be removed from doors installed in all climate zones of the U.S. without having a potential negative impact on the safety and utility of the walk-in. Therefore, DOE is screening out eliminated anti-sweat heater systems in this NOPR on the basis of safety of technology.

Furthermore, DOE is screening out the technology option to utilize insulation from the box/cooler wall to minimize door anti-sweat heat power recommended by Hussmann-Doors in its comment and discussed in section IV.A.2.b of this document. DOE recognizes that an ideally designed walk-in box ensures that panel design could reduce door sweating; however, DOE notes that since its walk-in test procedures evaluate the performance of walk-in components separately, these design pairings are not captured by the test procedure and therefore cannot be used to analyze higher efficiency levels.

c. Refrigeration Systems

In the June 2022 Preliminary Analysis, DOE tentatively determined that adaptive defrost, hot gas defrost, oil management systems, and economizer cooling would not affect the measured AWEF2 value of walk-in refrigeration systems based on appendix C1. DOE requested comment on the screened out technologies in section ES.4.3 of the June 2022 Preliminary Analysis TSD.

HTPG commented that it agrees that oil management systems, adaptive defrost, hot gas defrost, and economizer cooling do not affect rated energy consumption as measured under the test procedures for refrigeration systems. (HTPG, No. 35 at p. 4)

DOE has tentatively determined that oil management systems, adaptive defrost, hot gas defrost, and economizer cooling would not affect the measured AWEF2 value of walk-in refrigeration systems when measured using appendix C1.

In the June 2022 Preliminary Analysis, DOE also screened out three-phase motors as a design option. In general, three-phase motors can save energy compared to single-phase motors, however, use of three-phase motors requires three-phase power. Not all businesses that use walk-ins are equipped with three-phase power, and therefore must use single-phase equipment. DOE therefore screened out this design option on the grounds of utility.

HTPG commented that it agrees with screening out three-phase motors as a technology option. *Id.* In this NOPR analysis, DOE is screening out three-phase motors based on utility.

In response to the June 2022 Preliminary Analysis, AHRI-Wine recommended that DOE consider how a 50-percent increase in condenser face area would increase the footprint of a single-packaged wine cooler system and how this increase in footprint would affect the market. (AHRI-Wine, No. 39 at p. 2) DOE received similar feedback during manufacturer interviews. DOE notes that high-temperature walk-ins are often installed in residential applications that have standard stud spacing in walls and standard joist spacing in floors and ceilings; therefore, these units may be designed to fit between these structural members for construction and aesthetic reasons. DOE has tentatively determined that consumers would lose the compact feature of high-temperature refrigeration systems if the evaporator or condenser heat exchangers underwent a considerable increase in size. Therefore, DOE is proposing to screen out improved evaporator and condenser coils for high-temperature refrigeration systems on the grounds of customer utility due to the additional heat exchanger size needed for this technology option.

The screened out technologies for fully assembled walk-ins and each component of walk-ins are discussed in more detail in chapter 4 of the accompanying TSD.

2. Remaining Technologies

Through a review of each technology, DOE tentatively concludes that none of the identified technologies for whole walk-ins, listed in section IV.A.2.a, met all five screening criteria to be examined further as design options in DOE's NOPR analysis.

a. Doors and Panels

Through a review of each technology, DOE tentatively concludes that all of the other identified technologies for doors and panels, listed in section IV.A.2.b of this document met all five screening criteria to be examined further as design options in DOE's NOPR analysis. In summary, DOE did not screen out the following technology options:

- Glass system insulation performance for display doors,
- Occupancy sensors (lighting controls) for doors,
- Anti-sweat heater controls for doors,
- Improved frame systems and materials for non-display doors,
- Reduced anti-sweat heater systems for doors, and
- Increased insulation thicknesses up to 6 inches for non-display doors and panels.

In section ES.4.3 of the June 2022 Preliminary Analysis TSD, DOE requested comment on the screened in technologies. Hussmann-Doors stated that increased insulation thicknesses up to 6 inches for non-display doors and panels would help reduce insulation requirements on framing materials for door products and that increased wall thickness would offer additional insulation. (Hussmann-Doors, No. 33 at p. 3) DOE understands this comment to support increased insulation thicknesses up to 6 inches as a technology option for non-display doors and panels.

Additionally, Hussmann-Doors stated that the cost of applying controllers (*e.g.,* to control the on time of electrical components like lighting and anti-sweat heat) to door products is not economically justified by the resulting energy savings. However, Hussmann-Doors commented that it does use controllers on its products to be compliant with regulations. (Hussmann-Doors, No. 33 at p. 2) Hussmann-Doors also commented that it does not see a need for a change to the standard for doors based on the technology option of occupancy sensors. *Id.* DOE understands Hussmann-Doors comment to mean that it believes the energy consumption standard for doors should not change to reflect that occupancy sensors can reduce energy consumption. In response to these comments, DOE notes that it in addition to the screening analysis discussed above, it conducts a full engineering analysis to weigh the costs and energy savings of each potential design option. While DOE evaluates specific design options for the purposes of developing a representative cost-efficiency curve, manufacturers are not bound to implement the design options that DOE analyzes to meet a performance-based energy conservation standard. Manufacturers may employ any design option, whether DOE has evaluated it or not, so long as it meets the energy consumption standard based on the Federal test procedure. The engineering analysis is discussed further in section IV.C of this document.

DOE has initially determined that these technology options are technologically feasible because they are being used or have previously been used in commercially available equipment or working prototypes. DOE also finds that all of the remaining technology options meet the other screening criteria (*i.e.,* practicable to manufacture, install, and service and do not result in adverse impacts on consumer utility, product availability, health, or safety, unique-pathway proprietary technologies). For additional details, see chapter 4 of the NOPR TSD.

b. Refrigeration Systems

Through a review of each technology, DOE tentatively concludes that all the other identified technologies listed in section IV.A.2.c of this document met all five screening criteria to be examined further as design options in DOE's NOPR analysis. In summary, DOE did not screen out the following technology options for walk-in refrigeration systems:

- Hydrocarbon refrigerants,
- Higher efficiency compressors,
- Improved evaporator and condenser coil,
- Higher efficiency condenser fan motors,
- Improved condenser and evaporator fan blades,
- Ambient sub-cooling,
- Off-cycle evaporator fan control,
- Head pressure control,
- Variable-speed condenser fan control,
- Crankcase heater controls,
- Improved thermal insulation for single-packaged dedicated systems,
- Higher efficiency evaporator fan motors,
- On-cycle evaporator fan control, and
- Liquid suction heat exchanger.

In section ES.4.3 of the June 2022 Preliminary Analysis TSD, DOE requested comment on the screened in technologies. DOE received no comment on the screened in technologies for refrigeration systems.

DOE has initially determined that these technology options are technologically feasible because they are being used or have previously been used in commercially available products or working prototypes. DOE also finds that all the remaining technology options meet the other screening criteria (*i.e.,* practicable to manufacture, install, and service and do not result in adverse impacts on consumer utility, product availability, health, or safety, unique-pathway proprietary technologies). For additional details, see chapter 4 of the NOPR TSD

C. Engineering Analysis

The purpose of the engineering analysis is to establish the relationship between the efficiency and cost of each component of walk-ins (*e.g.,* doors, panels, and refrigeration systems). There are two elements to consider in the engineering analysis; the selection of efficiency levels to analyze (*i.e.,* the ''efficiency analysis'') and the determination of product cost at each efficiency level (*i.e.,* the ''cost analysis''). In determining the performance of higher-efficiency walk-ins, DOE considers technologies and design option combinations not eliminated by the screening analysis. For each walk-in component equipment class, DOE estimates the baseline cost, as well as the incremental cost for the walk-in component at efficiency levels above the baseline. The output of the engineering analysis is a set of cost-efficiency ''curves'' that are used in downstream analyses (*i.e.,* the LCC and PBP analyses and the NIA).

1. Efficiency Analysis

DOE typically uses one of two approaches to develop energy efficiency levels for the engineering analysis: (1) relying on observed efficiency levels in the market (*i.e.,* the efficiency-level approach), or (2) determining the incremental efficiency improvements associated with incorporating specific design options to a baseline model (*i.e.,* the design-option approach). Using the efficiency-level approach, the efficiency levels established for the analysis are determined based on the market distribution of existing products (in other words, based on the range of efficiencies and efficiency level ''clusters'' that already exist on the market). Using the design option approach, the efficiency levels established for the analysis are determined through detailed engineering calculations and/or computer simulations of the efficiency improvements from implementing specific design options that have been identified in the technology assessment. DOE may also rely on a combination of these two approaches. For example, the efficiency-level approach (based on actual products on the market) may be extended using the design option approach to ''gap fill'' levels (to bridge large gaps between other identified efficiency levels) and/or to extrapolate to the max-tech level (particularly in cases where the max-tech level exceeds the maximum efficiency level currently available on the market).

In this rulemaking, DOE relies on a design-option approach for doors, panels, dedicated condensing units, and single-packaged dedicated systems. DOE relies on both a design-option and an efficiency-level approach for unit coolers, depending on the equipment class. These approaches are discussed in the following sections.

a. Display Doors

Representative Units

As previously mentioned in section IV.A.1.a of this document, DOE evaluated equipment classes for display doors in the June 2022 Preliminary Analysis based on the presence or absence of a motor. In the June 2022 Preliminary Analysis, DOE analyzed three representative door sizes for manually opening display doors and two representative door sizes for motorized display doors. The representative units were based on the number of door openings within a common frame. Additionally, DOE based its representative door sizes on typical height and width of doors found in equipment product literature. *See* section 5.3.1 of chapter 5 of the June 2022 Preliminary Analysis TSD. DOE sought comment on the representative units selected in section ES.4.5 of the June 2022 Preliminary Analysis TSD.

In response, Hussmann-Doors commented that the representative door sizes used in the analysis are appropriate; however, Hussmann-Doors stated that it sells a sliding door that is larger than the representative units. (Hussmann-Doors, No. 33 at p. 3) DOE notes that the representative units it selects for analysis are intended to be representative of the display door industry as a whole and cannot capture every door available on the market. Additionally, DOE ultimately did not define representative units for motorized display doors in this NOPR since, as discussed in section IV.A.1.a of this document, DOE did not evaluate higher efficiency levels for these doors in its analysis. However, DOE may consider evaluating higher efficiency levels for motorized display doors in a future rulemaking, at which time it would determine representative units based on the market at that time.

DOE received no comments on the manually opening display door representative units; therefore, in this NOPR, DOE maintained the same manually opening display door representative units that were evaluated in the June 2022 Preliminary Analysis. Table IV.6 lists the display door classes and sizes that DOE analyzed in its engineering analysis for this NOPR, where the dimensions listed are consistent with the surface area that is used to determine the maximum daily energy consumption.

TABLE IV.6—REPRESENTATIVE UNITS ANALYZED FOR DISPLAY DOORS

Opening mechanism	Temperature	Class code	Number of door openings	Dimensions height × length, ft
Manual	Medium-temperature	DW.M	1	6.25 × 2.5
			3	6.25 × 7.5
			5	6.25 × 12.5
	Low-temperature	DW.L	1	6.25 × 2.5
			3	6.25 × 7.5
			5	6.25 × 12.5

Baseline Efficiency, Design Options, and Higher Efficiency Levels

To determine the baseline efficiency of manually opening display doors in the June 2022 Preliminary Analysis, DOE relied on the current energy conservation standards and minimum prescriptive requirements for the glass pack of transparent reach-in doors at 10 CFR 431.306(b)(1)–(2). DOE's analysis suggested that manufacturers already implement high-efficiency frame designs to minimize thermal transmission; therefore, DOE included high-efficiency frame designs as a baseline design option for manually opening display doors in the June 2022 Preliminary Analysis.

In the June 2022 Preliminary Analysis, DOE evaluated the design options listed in Table IV.7 for manually opening display doors. As noted, design option DR1 includes baseline design options; additional design options are evaluated in DR2 (efficiency level 1) and DR3 (efficiency level 2).

TABLE IV.7—DESIGN OPTIONS EVALUATED IN THE JUNE 2022 PRELIMINARY ANALYSIS AND THIS NOPR ANALYSIS FOR DISPLAY DOORS

Efficiency level	Design option code	Description	
		Medium-temperature, manual display doors	Low-temperature, manual display doors
0 (Baseline)	DR1	2-pane glass with argon gas fill	3-pane glass with argon gas fill.
1	DR2	3-pane glass with argon gas fill	3-pane glass with krypton gas fill.
2	DR3	2-pane vacuum-insulated glass	2-pane vacuum-insulated glass.

In response to the June 2022 Preliminary Analysis, Hussmann-Doors commented that vacuum-insulated glass on a sliding door affects the U-factor. DOE interprets this comment to suggest that vacuum-insulated glass could be used to reach higher efficiency levels for all display doors, including manually opening display doors. DOE notes that vacuum-insulated glass is the maximum technology option for manually opening display doors.

DOE received no other comments on the design options or efficiency levels for manually opening display doors. In this NOPR analysis, DOE maintained the same baseline efficiency level, design options, and higher efficiency levels that it evaluated in the June 2022 Preliminary Analysis.

b. Non-Display Doors

Representative Units

As previously mentioned in section IV.A.1.a of this document, DOE evaluated equipment classes for non-display doors based on the presence or absence of a motorized door opener in the June 2022 Preliminary Analysis. DOE analyzed three representative sizes for each class of non-display doors based on the representative sizes analyzed for both passage and freight doors in the June 2014 Final Rule and based on typical height and width of doors found in current equipment product literature. *See* section 5.3.1 of chapter 5 of the preliminary analysis TSD. DOE sought comment on the representative units selected in section ES.4.5 of the preliminary analysis TSD. DOE did not receive any stakeholder comments with respect to non-display door representative units.

In this NOPR analysis, DOE modified the non-display door representative sizes that it evaluated based on further review of product literature and interviews with manufacturers. Table IV.8 lists the non-display door classes and sizes that DOE analyzed in the engineering analysis for this NOPR.

TABLE IV.8—REPRESENTATIVE UNITS ANALYZED FOR NON-DISPLAY DOORS

Opening mechanism	Temperature	Class code	Size	Dimensions, height × length, in
Manual	Medium-temperature	NM.M	Small	84 × 38
			Medium	90 × 40
			Large	96 × 56
	Low-temperature	NM.L	Small	84 × 38
			Medium	90 × 40
			Large	96 × 56
Motorized	Medium-temperature	NO.M	Small	100 × 66
			Medium	118 × 90
			Large	154 × 90
	Low-temperature	NO.L	Small	100 × 66
			Medium	118 × 90
			Large	154 × 90

Baseline Efficiency, Design Options, and Higher Efficiency Levels

To determine non-display door baseline efficiency, DOE relied on the current energy conservation standards. For the June 2022 Preliminary Analysis, based on certifications in the private certification and compliance management system (''CCMS'') database and product literature, DOE assumed that baseline non-display doors had 3.5-inch-thick insulation for coolers and 4-inch-thick insulation for freezers, wood framing materials, anti-sweat heat with no controls, and lighting with no controls.

For the June 2022 Preliminary Analysis, DOE evaluated the design options listed in Table IV.9 for non-display doors. While DOE largely maintained these design options in its analysis for this NOPR, there were a few changes specific to their implementation, discussed in more detail below.

TABLE IV.9—DESIGN OPTIONS EVALUATED IN THE JUNE 2022 PRELIMINARY ANALYSIS FOR NON-DISPLAY DOORS

Design option code	Description
	Occupancy sensors (lighting controls).
LNC	No lighting controls.
LCTRL	Lighting controls.
	Anti-sweat heater wire controls.
ASHNC	No anti-sweat heater controls.
ASCTRL	Anti-sweat heater controls.
	Improved frame systems and lower conductivity framing materials.
FR1	Baseline non-display door frame made of wood.
FR2	Improved non-display door frame made of insulation.
	Decreased anti-sweat heater power.
ASH1	Baseline anti-sweat heater power.
ASH2	Reduced or eliminated anti-sweat heater power.
	Increased Insulation Thickness.
TCK1	Baseline insulation thickness.
TCK2	Increased insulation thickness 1.
TCK3	Increased insulation thickness 2.
TCK4	Increased insulation thickness 3.

In the June 2022 Preliminary Analysis, DOE included lighting in baseline manually opening non-display doors. DOE's research at the time indicated that non-display doors sometimes include lighting and switches to operate that lighting. Therefore, DOE was able to use lighting controllers as a design option for the representative units it modeled. However, upon further review of the market, DOE found that lighting may or may not be included with non-display doors. Therefore, DOE removed lighting from its baseline representative units of manually opening non-display doors in this NOPR, thus removing the use of the lighting controller as a design option in its analysis of non-display doors.

In the June 2022 Preliminary Analysis, DOE combined improved non-display door framing systems and materials with reduced or eliminated anti-sweat heater power. In section ES.4.6 of the June 2022 Preliminary Analysis TSD, DOE requested comment on its assumptions that anti-sweat heater power can be reduced or eliminated by use of improved framing systems and materials. If anti-sweat heater power can be reduced through other means of design or technology options for doors, DOE sought specific data on the achievable reduction in anti-sweat heater power and the cost to implement. DOE received no comment on whether improving framing systems and materials could reduce anti-sweat heater or by how much anti-sweat heater power could potentially be reduced.

In this NOPR analysis, DOE decoupled improved frame systems and materials from the reduction in anti-sweat heater power and implemented these as separate design options. Additionally, in this NOPR analysis, rather than present a fixed value of anti-sweat heater wire power in watts, DOE is presenting the amount of anti-sweat heater power in terms of rated power per linear foot, which can be converted into the total anti-sweat heater power per representative unit using door leaf dimensions. DOE recognizes that the total value of anti-sweat heater power will vary based on the size of the door leaf but that manufacturers generally use wire with the same rating of power per linear foot across doors of different sizes. DOE is presenting anti-sweat heat in terms of a rated power per linear foot and is soliciting feedback on the values used in this analysis.

In the June 2022 Preliminary Analysis, DOE had considered eliminated anti-sweat heater power as a design option for medium-temperature non-display doors, however, as discussed in section IV.B.1.b of this document, DOE is no longer considering elimination of anti-sweat heater systems as a design option since DOE does not have sufficient evidence to demonstrate that doors without anti-sweat heat could be installed in all climates or installation locations. Instead, DOE has tentatively concluded in this NOPR that cooler doors could reduce anti-sweat heater power. Based on certified information in DOE's private CCMS database, approximately 93 percent of models reported a rated anti-sweat heater power of less than or equal to 2 W/ft; therefore, DOE evaluated the energy savings and cost associated with reducing rated anti-sweat heater power from baseline levels to 2 W/ft.

For low-temperature non-display doors, in the June 2022 Preliminary Analysis, DOE determined reduced anti-sweat heater power values based on a line of best fit of anti-sweat heater power versus door area from the lower third of non-zero anti-sweat heater power values certified in DOE's private CCMS database. *See* section 5.7.1.4 of chapter 5 of the June 2022 Preliminary Analysis TSD. In this NOPR analysis, based on a combination of certified values in CCMS, rated anti-sweat heater power per linear foot of wire based on product literature, and information received during confidential interviews with manufacturers, DOE has tentatively concluded that freezer doors may be able to implement a reduced rated anti-sweat heater system power of 5 W/ft.

Table IV.10 shows the baseline and reduced anti-sweat heater wire power evaluated in this NOPR for each equipment class. The design options that DOE evaluated for non-display doors for the NOPR analysis are shown in Table IV.11.

TABLE IV.10—ANTI-SWEAT HEATER WIRE POWER PER LINEAR FOOT USED IN NOPR ANALYSIS

Equipment class	Baseline anti-sweat heater wire power rating (W/ft)	Reduced anti-sweat heater wire power rating (W/ft)
Medium-Temperature, Manually-Opening Non-Display Doors	4	2
Low-Temperature, Manually-Opening Non-Display Doors	10	5
Medium-Temperature, Motorized Non-Display Doors	4	2
Low-Temperature, Motorized Non-Display Doors	9.5	5

TABLE IV.11—DESIGN OPTIONS EVALUATED IN THIS NOPR ANALYSIS FOR NON-DISPLAY DOORS

Design option code	Description
	Anti-sweat heater wire controls.
ASHNC	No anti-sweat heater controls.
ASCTRL	Anti-sweat heater controls.
	Improved frame systems and lower conductivity framing materials.
FR1	Baseline non-display door framing made of wood.
FR2	Improved non-display door framing made of insulation.
	Decreased anti-sweat heater power.
ASH1	Baseline anti-sweat heater power.
ASH2	Reduced anti-sweat heater power.
	Increased Insulation Thickness.
TCK1	Baseline insulation thickness.
TCK2	Increased insulation thickness 1.
TCK3	Increased insulation thickness 2.
TCK4	Increased insulation thickness 3.

DOE seeks comment on the baseline and assumed reduction in anti-sweat heater wire power listed in Table IV.10. DOE specifically seeks feedback on whether the reduced anti-sweat heater wire power is acceptable for use in walk-in doors at all climates and installations throughout the U.S.

c. Panels

Representative Units

In the June 2022 Preliminary Analysis, DOE evaluated the same representative units for each panel equipment class that it evaluated for the June 2014 Final Rule. *See* section 5.3.2 of chapter 5 of the June 2022 Preliminary Analysis TSD. DOE requested comment on these panel representative units in section ES.4.5 of the June 2022 Preliminary Analysis TSD. DOE did not receive any comments regarding the representative units analyzed for panels. Therefore, DOE maintained the same representative units it evaluated in the June 2022 Preliminary Analysis for this NOPR analysis. Table IV.12 summarizes the representative units evaluated for walk-in panel equipment classes.

TABLE IV.12—REPRESENTATIVE UNITS ANALYZED FOR PANELS IN THIS NOPR

Equipment	Temperature	Equipment class code	Dimensions height × length, ft
Structural	Medium	PS.M	8 × 1.5 8 × 4 9 × 5.5
Structural	Low	PS.L	8 × 1.5 8 × 4

TABLE IV.12—REPRESENTATIVE UNITS ANALYZED FOR PANELS IN THIS NOPR—Continued

Equipment	Temperature	Equipment class code	Dimensions height × length, ft
Floor		PF.L	9 × 5.5 8 × 2 8 × 4 9 × 6

Baseline Efficiency, Design Options and Efficiency Levels

For panels, DOE evaluated increasing insulation thickness to obtain higher insulation R-values as calculated pursuant to appendix B of subpart R to 10 CFR 431. The thermal resistance of insulating materials increases approximately linearly with material thickness.

For determining the baseline efficiency level, DOE relied on the current R-value standards. Based on DOE's analysis of the market, 3.5 inches of foam insulation is generally used for baseline medium-temperature panels and low-temperature floor panels, while 4 inches of foam insulation is used in baseline low-temperature structural panels to meet the minimum R-value requirements specified in 10 CFR 431.306(a)(3)–(4).

In addition, DOE found that many panel manufacturers offer insulation in thicknesses of 4, 5, and 6 inches. DOE also observed that the majority (approximately 75 percent) of the market uses polyurethane insulation, with the remainder using extruded polystyrene (''XPS''), expanded polystyrene, and polyisocyanurate insulation in its walk-in panels. Therefore, DOE assessed the incremental increase in R-value for polyurethane insulation at 4, 5, and 6 inches as design options, with 6 inches being the max-tech design option.

d. Dedicated Condensing Units and Single-Packaged Dedicated Systems

Refrigerants Analyzed

In the June 2022 Preliminary Analysis, DOE assumed R–448A as a refrigerant for medium- and low-temperature dedicated condensing units and single-packaged dedicated systems. Based on the available compressor performance coefficients, and an examination of the refrigerant compositions, DOE tentatively concluded that R–448A and R–449A have nearly identical performance characteristics for walk-in applications and that AWEF2 standards would not be meaningfully changed if analysis was conducted using R–449A instead of R–448A. R–448A/R–449A was chosen because the walk-in industry is shifting to lower global warming potential (''GWP'') refrigerants. R–448A/R–449A have much lower GWP compared to R–404A—additionally R–448A/R–449A has a higher glide, which will tend to disadvantage dedicated condensing units when they are tested alone according to the DOE test procedure. In other words, R–448A/R–449A are the most conservative, lower GWP, widely available refrigeration options. For the June 2022 Preliminary Analysis, DOE used R–134A in its evaluation of high-temperature single-packaged dedicated units since this is the only refrigerant option currently offered for this equipment.

DOE requested comment on whether the refrigerants used are representative of the current and future walk-in market in section ES.4.8 of the June 2022 Preliminary Analysis TSD. In response to the June 2022 Preliminary Analysis, DOE received several comments on the refrigerants used in the analysis and on the need to consider lower GWP refrigerants.

HTPG agreed with DOE using R–448A and R–449A in its analysis of medium- and low-temperature dedicated condensing units, specifically the compressor coefficients and the reduction in mass flow rate. (HTPG, No. 35 at pp. 3, 6) AHRI agreed with DOE using R–448A and R–449A in its analysis, however, it recommended that A2L [26] or other refrigerants (*i.e.,* R–454A, R–454C, R–455A, R–744A) be considered in a future analysis. (AHRI, No. 39 at p. 3) Hussmann-Refrigeration stated that due to the Environmental Protection Agency (''EPA'') regulations,[27] changes to refrigerants are expected and further analysis of system performance may be required to determine the efficiency impact of the new refrigerants. (Hussmann-Refrigeration, No. 38 at p. 2) Hussmann-Refrigeration additionally commented that it agrees with the views of other AHRI members on the matter of the transition to A2L refrigerants and stated that R–448A and R–449A will not be available for future markets and are currently not available for new applications at a charge level greater than 50 pounds in California. (Hussmann-Refrigeration, No. 38 at p. 4) Lennox commented that R–448A and R–449A are not representative of the future market, which would likely consist of R–454A, R–454C, R–455A, and R–744. (Lennox, No. 36 at p. 5) Lennox also stated that R–744 (*i.e.,* CO_2) could pose a significant challenge if it is required for transcritical operation.[28] *Id.* Lennox recommended that DOE consider the technological feasibility, performance, and cost impacts of the transition to lower GWP refrigerants, specifically A2L and CO_2 refrigerants, when proposing energy conservation standards. (Lennox, No. 36 at pp. 1–3). HTPG also recommended that DOE consider the transition to low-GWP refrigerants in its analysis. (HTPG, No. 35 at p. 6)

EPA published a NOPR, ''Phasedown of Hydrofluorocarbons: Restrictions on the Use of Certain Hydrofluorocarbons Under Subsection (i) the American Innovation and Manufacturing Act of 2020'', on December 15, 2022, as a part of the American Innovation and Manufacturing (''AIM'') Act (''December 2022 AIM NOPR'') which outlined new refrigerant regulations regarding acceptable GWP limits for various air conditioning and refrigeration systems. 87 FR 76738. One proposal in the December 2022 AIM NOPR is to limit the GWP of refrigerants in remote condensing units used in retail food refrigeration or cold storage warehouse systems to 300 GWP or less if the system's refrigerant charge is less than 200 pounds. As proposed, this limit

[26] A2L is a refrigerant classification from the American Society of Heating, Refrigeration, and Air-Conditioning Engineers (''ASHRAE'') Standard 34: ''Designation and Safety Classification of Refrigerants''. The A2L class defines refrigerants that are nontoxic, but mildly flammable. Refrigerants in this classification include R–454A, R–454C, and R–455A.

[27] *See* ''Phasedown of Hydrofluorocarbons: Allowance Allocation Methodology for 2024 and Later Years'', 87 FR 66372.

[28] CO_2 refrigeration systems are transcritical because the high-temperature refrigerant that is cooled by ambient air is in a supercritical state, above the 87.8 °F critical point temperature, above which the refrigerant cannot exist as separate vapor and liquid phases.

would take effect on January 1, 2025. DOE has tentatively determined that walk-in refrigeration systems within the scope of this energy conservation standards rulemaking, designed to cool a chilled storage area less than 3,000 square feet, would not exceed 200 pounds of refrigerant charge and would therefore be subject to the GWP limitations proposed in the December 2022 AIM NOPR. R–448A and R–449A have GWPs of just under 1,400, well over the proposed 300 GWP limit. Therefore, DOE acknowledges that by the compliance date of any potential standards promulgated by this rulemaking, R–448A and R–449A may no longer be permitted for use in walk-in refrigeration systems if the proposals in the December 2022 AIM NOPR are finalized.

For this NOPR, to estimate potential performance penalties associated with transitioning from R–448A and R–449A to a lower GWP refrigerant, DOE modeled the performance of three potential replacement A2L refrigerants: R–454A, R–454C, and R–455A. At the DOE test conditions prescribed for dedicated condensing units tested alone, R–407A, R–448A and R–454A have condenser glides of less than 9 °F, R454C has a glide of roughly 12 °F, and R455A has a glide or roughly 17 °F. When analyzed with available compressor coefficients, DOE found that R–454A had a coefficient of performance higher than R–407A and R–448A, while R455A and R–454C had coefficients of performance that were lower than R–407A and R–448A. Of the three refrigerants with GWPs less than 300, R–454A has the lowest glide and highest coefficient of performance. Based on these results, DOE has tentatively determined that R–454A would be the most likely replacement for R–407A, R–448A, and R–449A in walk-in applications if the proposals in the December 2022 AIM NOPR are adopted. DOE further analyzed the compression efficiency of R–454A compared to R–448A and has tentatively determined that walk-in dedicated condensing systems would not suffer a performance penalty when switching from R–407A, R–448A, or R–449A to R–454A.

DOE attempted to corroborate these modeling results with data from testing. During interviews, DOE asked if manufacturers had tested any A2L refrigerants such as R–454A, R–454C, and R–455A. At the time, manufacturers indicated that they were not able to obtain a sufficient quantity of these refrigerants for testing. Manufacturers stated that chemical companies that manufacturer these refrigerants were still in the process of formulating these refrigerant blends. Additionally, manufacturers emphasized that there was not yet industry consensus on the best refrigerant to move forward with given the information they have about refrigerants and regulations at this time. As such, DOE was not able to compare its modeling results to real-world tests prior to the publication of this NOPR.

In response to the December 2022 AIM NOPR the Chemours Company FC, LLC (''Chemours'') submitted a comment in which they presented results from an analysis comparing the performance of various refrigerants. (Chemours, EPA–HQ–OAR–2021–0643 No. 141 at p. 12) That analysis showed that R–454A has similar, if not better, performance to refrigerants used in walk-in coolers today. *Id.* Chemours generally supported R–454A as a replacement for higher GWP refrigerants. *Id.*

DOE has tentatively determined that any standards set based on an analysis of dedicated condensing units operating with R–448A or R–449A would be appropriate for units operating with R–454A. DOE has therefore continued to use R–448A as the baseline refrigerant for all medium- and low-temperature dedicated condensing units and single-packaged dedicated systems in this NOPR analysis.

DOE requests test results or performance data for walk-in refrigeration systems using R–454A, R–454C, and/or R–455A. Additionally, DOE requests comment on its tentative determination that R–454A is the most likely replacement for R–448A and R–449A with a GWP of less than 300 and that walk-in dedicated condensing systems would not suffer a performance penalty when switching from R–448A or R–449A to R–454A.

DOE did not consider R–744 (CO_2) as a potential refrigerant for this NOPR analysis. During interviews, manufacturers stated that while CO_2 may be a viable option for larger grocery store rack condenser installations, CO_2 is unlikely to be commonly adopted for walk-in dedicated condensing systems in response to a low-GWP transition. Based on this feedback, DOE has tentatively determined that analyzing CO_2 dedicated condensing systems would not be representative of the industry as a whole and would not provide insight into the performance of walk-in dedicated condensing systems after the low-GWP transition.

DOE also did not analyze R–290 (propane) as a potential refrigerant in the June 2022 Preliminary Analysis because DOE lacked R–290 performance data for walk-in systems. *See* the June 2022 Preliminary Analysis TSD, chapter 2, section 2.4.3.2 for details. In response to this, AHRI stated that some companies have transitioned smaller charge walk-in refrigeration system products to propane. (AHRI, no. 39 at p. 5) DOE is aware that there are single-packaged dedicated systems currently on the market that use R–290 as a refrigerant for use in walk-in systems. In this NOPR analysis, DOE collected additional performance data for R–290 compressors and has included R–290 in its analysis of medium- and low-temperature single-packaged dedicated systems. The current charge limits for A3 (flammable) refrigerants are limited to 150 grams.[29] DOE has determined that all split system walk-in refrigeration systems would exceed this limit, so DOE did not analyze R–290 as a refrigerant for dedicated condensing units. Additionally, DOE was unable to identify compressors for high-temperature applications designed for use with R–290. As such, DOE did not analyze high-temperature refrigeration systems using R–290.

AHRI commented that when transitioning from non-flammable refrigerants to R–290, other components must be upgraded to comply with UL60335–2–89 [30] requirements. (AHRI, No. 39 at p. 6) Furthermore, AHRI stated that few state and local building codes are updated to handle charging refrigeration equipment that use A3 refrigerants and storing the necessary quantities of flammable refrigerants to supply end-user needs. *Id.* AHRI also commented that charge sizes may need to be increased; however, this may only be possible when doors are not present on equipment. (AHRI, No. 39 at p. 6) In this NOPR, DOE assumed that refrigerant system component costs would increase to comply with safety standards when switching from non-flammable refrigerants to R–290. These cost increases are associated with ensuring all components are spark proof. Details of DOE's cost analysis are discussed in more detail in chapter 5 of the accompanying TSD. Additionally, DOE limited each refrigeration circuit using R–290 to 150 grams of charge in its analysis to comply with current regulations. DOE is aware of commercial refrigeration systems and walk-in

[29] EPA published a final rule pertaining to hydrocarbon refrigerants on December 20, 2011. FR 76 78832. This rule limits the acceptable charge of propane in a refrigeration circuit to 150 grams for refrigeration systems with end-uses in the retail food industry. FR 76 78832, 78836.

[30] UL standard ''Household and Similar Electrical Appliances—Safety—Part 2–89: Particular Requirements for Commercial Refrigerating Appliances and Ice-Makers with an Incorporated or Remote Refrigerant Unit or Motor-Compressor''

refrigeration systems currently on the market that use propane as a refrigerant. As such, DOE has tentatively determined that building codes and local regulations are in-place for refrigeration systems charged with A3 refrigerants.

In the June 2022 Preliminary Analysis, DOE analyzed high-temperature refrigeration systems using R–134A. In response to this analysis, AHRI-Wine commented that wine cellar manufacturers agree with DOE using R–134A and stated that adopting other refrigerants may not be viable for high-temperature units. (AHRI-Wine, No. 39 at p. 5) Feedback from manufacturer interviews indicates that manufacturers are not currently aware of a reasonable replacement for R–134A. Based on manufacturer feedback and manufacturer product catalogs, DOE has tentatively determined that high-temperature refrigeration systems currently on the market are only available with R–134A. Therefore, DOE only evaluated R–134A for high-temperature units in this NOPR analysis. DOE notes that if the proposals in the December 2022 AIM NOPR are finalized, R–134A would be banned for use in walk-in coolers and a low-GWP substitute would be required. If a low-GWP replacement becomes available for R–134A and DOE determines that the performance of this hypothetical refrigerant is sufficiently different than R–134A, DOE may analyze that refrigerant for high-temperature systems as a part of this rulemaking or a future rulemaking.

DOE requests comment on any potential low-GWP replacements for high-temperature systems. Additionally, DOE requests high-temperature performance data or test results for any potential low-GWP alternatives to R–134A.

Representative Units

In the June 2022 Preliminary Analysis, DOE chose representative units to span the range of capacities sold for each equipment class. *See* section 5.3.3 of chapter 5 of the June 2022 Preliminary Analysis TSD. Table IV.13 summarizes the representative dedicated condensing units and single-packaged dedicated system units evaluated in the June 2022 Preliminary Analysis. DOE requested comment on these representative units in section ES.4.5 of the June 2022 Preliminary Analysis TSD.

TABLE IV.13—JUNE 2022 PRELIMINARY ANALYSIS REPRESENTATIVE UNITS FOR DEDICATED CONDENSING UNITS AND SINGLE-PACKAGED DEDICATED SYSTEMS

System	Temperature	Location	Equipment class code	Capacities analyzed (Btu/h)
Dedicated Condensing Unit	Medium	Outdoor	DC.M.O	9,000 25,000 54,000
		Indoor	DC.M.I	9,000 25,000 54,000
	Low	Outdoor	DC.L.O	3,000 9,000 25,000 54,000
		Indoor	DC.L.I	3,000 9,000 25,000 54,000
Single-Packaged Dedicated Systems	High (Non-ducted)	Outdoor	SPU.H.O	2,000 9,000
		Indoor	SPU.H.I	2,000 9,000
	High (Ducted)	Outdoor	SPU.H.O.D	9,000
		Indoor	SPU.H.I.D	9,000
	Medium	Outdoor	SPU.M.O	2,000 9,000
		Indoor	SPU.M.I	2,000 9,000
	Low	Outdoor	SPU.L.O	2,000 9,000
		Indoor	SPU.L.I	2,000 9,000

In response, the Efficiency Advocates and HTPG commented that DOE should consider analyzing additional representative units to provide a broader range of capacities to help set standards as a function of capacity. (Efficiency Advocates, No. 37 at p. 4; HTPG, No. 35 at p. 5) Specifically, HTPG suggested analyzing the following representative units for dedicated condensing units:

- Medium-temperature, indoor, hermetic, 3,000 Btu/h,
- Medium-temperature, indoor, scroll, 6,000 Btu/h,
- Medium-temperature, outdoor, hermetic, 3,000 Btu/h,
- Medium-temperature, outdoor, scroll, 6,000 Btu/h,
- Medium-temperature, outdoor, semi-hermetic, 175,000 Btu/h,
- Low-temperature, indoor, hermetic, 4,000 Btu/h,
- Low-temperature, indoor, scroll, 3,000 Btu/h,
- Low-temperature, outdoor, hermetic, 4,000 Btu/h,
- Low-temperature, outdoor, scroll, 3,000 Btu/h, and
- Low-temperature, outdoor, semi-hermetic, 120,000 Btu/h.

(HTPG, No. 35 at p. 5)

As discussed in section IV.A.1.c, lower-capacity compressors are less efficient than higher capacity compressors. While the standards for low-temperature dedicated condensing systems take this into account, current standards for the medium-temperature dedicated condensing systems do not. Based on testing and its analysis of the compliance certification database (''CCD'') and manufacturer literature, DOE has tentatively determined that medium-temperature dedicated condensing units below around 4,000 Btu/h would have to be equipped with all available design options to meet the current standards. As such, DOE did not evaluate higher efficiency levels for lower capacity medium-temperature dedicated condensing units in this NOPR; instead, DOE is proposing to maintain the current standard level for this equipment. Standards proposed for these units in this NOPR were converted from the current AWEF metric to the AWEF2 metric based on the appendix C1 test procedure.

Lennox commented that it generally agrees with the capacities chosen but suggested that the analysis could be improved by including larger capacity products. (Lennox, No. 36 at p. 2) AHRI suggested that DOE refer to its capacity suggestion in its response to the WICF TP NOPR,[31] which included a recommendation to analyze larger capacity representative units such as 96,000 Btu/h. (AHRI, No. 39 at pp. 2–3) Hussmann-Refrigeration and Lennox stated that they agree with AHRI's recommendation that DOE evaluate a larger capacity unit of 96,000 Btu/h as a representative unit for dedicated condensing units. (Hussmann-Refrigeration, No. 38 at p. 3; Lennox, No. 36 at pp. 3–4) Lennox added that the recommendation to include a high-capacity representative unit is based on the number of basic models in the CCD. (Lennox, No. 36 at pp. 3–4)

Based on stakeholder feedback and the number of certified basic models in the CCD, DOE has included additional lower and higher capacity representative units in its NOPR analysis. Specifically, DOE has included 75,000 Btu/h medium-temperature outdoor and indoor dedicated condensing units, a 124,000 Btu/h medium-temperature outdoor dedicated condensing unit, and a 75,000 Btu/h low-temperature outdoor dedicated condensing unit. Additionally, DOE analyzed 2,000 Btu/h and 9,000 Btu/h medium-temperature, indoor and outdoor single-packaged dedicated systems and 2,000 Btu/h and 6,000 Btu/h low-temperature, indoor and outdoor single-packaged dedicated systems. As discussed in section IV.A.1.c of this document, DOE did not analyze smaller medium-temperature dedicated condensing units as it has tentatively determined that the units on the market are already at the maximum technology level.

AHRI-Wine recommended that DOE consider using representative units specific to the high-temperature and wine cellar cooling industry, with a range of capacities from 1,000 Btu/h to 18,000 Btu/h. (AHRI-Wine, No. 39 at p. 3) AHRI-Wine also recommended including indoor and outdoor high-temperature dedicated condensing systems with capacities of 2,000 Btu/h, 9,000 Btu/h, and 25,000 Btu/h. (AHRI, No. 39 at p. 3) Furthermore, AHRI-Wine suggested that DOE analyze 2,000 Btu/h and 9,000 Btu/h high-temperature ducted and non-ducted, indoor and outdoor single-packaged dedicated systems. (*Id.*)

DOE interprets AHRI-Wine's recommendation to evaluate additional dedicated condensing system representative units to refer to dedicated condensing units and matched refrigeration systems. As discussed in section IV.A.1.c of this document, DOE only analyzed high-temperature single-packaged dedicated systems in this NOPR analysis and is proposing a single high-temperature equipment class for matched refrigeration systems and single-packaged dedicated systems. Based on manufacturer feedback and a review of high-temperature product literature, DOE analyzed 2,000 Btu/h and 7,000 Btu/h, indoor and outdoor, ducted and non-ducted high-temperature single-packaged dedicated systems for this NOPR analysis. DOE did not encounter single-packaged high-temperature units with a capacity of over 7,000 Btu/h. As discussed in section IV.A.1.c of this document, DOE did not analyze high-temperature matched refrigeration systems separately from single-packaged dedicated systems since DOE has tentatively concluded that single-packaged dedicated systems are representative of the majority of the high-temperature market. Therefore, DOE did not analyze any representative units for high-temperature single-packaged dedicated systems larger than 7,000 Btu/h for this NOPR analysis.

AHRI-Wine requested that DOE clarify how capacity factors into DOE's high-temperature analysis and observed that if the lowest capacity for high-temperature systems is 9,000 Btu/h with a rotary compressor, then any unit with a capacity below 9,000 Btu/h with a hermetic compressor may be at a disadvantage. *Id.*

In this NOPR analysis, the capacity of a representative unit determines its characteristics, components, and design. For example, DOE analyzed 7,000 Btu/h high-temperature representative units with a rotary compressor and analyzed 2,000 Btu/h high-temperature representative units with a hermetic compressor based on DOE's review of the market. DOE is proposing standards for high-temperature refrigeration systems in this rulemaking that vary with capacity.

Table IV.14 lists the representative capacities evaluated in this NOPR for walk-in dedicated condensing units and single-packaged dedicated systems. More details on the representative units DOE selected for dedicated condensing units and single-packaged dedicated systems are in chapter 5 of the accompanying TSD.

TABLE IV.14—REPRESENTATIVE UNITS ANALYZED FOR DEDICATED CONDENSING UNITS AND SINGLE-PACKAGED DEDICATED SYSTEMS

System	Temperature	Location	Class code	Capacity (Btu/h)
Dedicated Condensing Units	Medium	Outdoor	DC.M.O	9,000 25,000 54,000 75,000 124,000

[31] See Docket No. EERE–2017–BT–TP–0010–0022 at *www.regulations.gov.*

TABLE IV.14—REPRESENTATIVE UNITS ANALYZED FOR DEDICATED CONDENSING UNITS AND SINGLE-PACKAGED DEDICATED SYSTEMS—Continued

System	Temperature	Location	Class code	Capacity (Btu/h)
		Indoor	DC.M.I	9,000
				25,000
				54,000
				75,000
	Low	Outdoor	DC.L.O	3,000
				9,000
				25,000
				54,000
				75,000
		Indoor	DC.L.I	9,000
				25,000
				54,000
Single-Packaged Dedicated Systems	High (Non-ducted)	Outdoor	SPU.H.O	2,000
				7,000
		Indoor	SPU.H.I	2,000
				7,000
	High (Ducted)	Outdoor	SPU.H.O.D	2,000
				7,000
		Indoor	SPU.H.I.D	2,000
				7,000
	Medium	Outdoor	SPU.M.O	2,000
				9,000
		Indoor	SPU.M.I	2,000
				9,000
	Low	Outdoor	SPU.L.O	2,000
				6,000
		Indoor	SPU.L.I	2,000
				6,000

Design Options

In the June 2022 Preliminary Analysis, DOE used a design option approach to evaluate potential efficiency improvements for walk-in dedicated condensing units and single-packaged dedicated systems. DOE considered the technologies listed in Table IV.15 as design options for dedicated condensing units and single-packaged dedicated systems.

TABLE IV.15—JUNE 2022 PRELIMINARY ANALYSIS REFRIGERATION SYSTEM DESIGN OPTIONS

	Dedicated condensing units	Single-packaged dedicated systems
All Units	• Improved condenser coil • Higher efficiency condenser fan motors • Improved fan blades	• Improved condenser coil. • Higher efficiency condenser fan motors. • Off-cycle evaporator fan control. • Improved thermal insulation. • Improved fan blades.
Outdoor Only	• Crankcase heater controls • Variable-speed condenser fan control • Ambient sub-cooling • Head pressure control	• Crankcase heater controls. • Variable-speed condenser fan control. • Ambient sub-cooling. • Head pressure control.
High-temperature		• Higher efficiency compressors.

Some design options passed the screening analysis but were not evaluated in the June 2022 Preliminary Analysis. DOE did not analyze higher efficiency evaporator fan motors in the June 2022 Preliminary Analysis since EPCA prescribes use of either electronically commutated motors (''ECMs'') or 3-phase motors (42 U.S.C. 6213(f)(1)(E)). DOE did not have sufficient data for the June 2022 Preliminary Analysis to evaluate variable-capacity compressors, hydrocarbon refrigerants, improved evaporator coils, and liquid suction heat exchangers. Finally, DOE did not analyze on-cycle evaporator fan control since variable-capacity compressors are a prerequisite for this design option to be effective.

As discussed in the Refrigerants Analyzed subsection of section IV.C.1.d of this document, DOE included hydrocarbon refrigerants in this NOPR analysis. Stakeholder comments pertaining to hydrocarbon refrigerants are addressed in the Refrigerants Analyzed subsection.

In section ES.4.6 of the June 2022 Preliminary Analysis TSD, DOE specifically requested data and feedback on improved evaporator coils for single-packaged dedicated systems and liquid suction heat exchangers for refrigeration systems.

DOE received no comments regarding improved evaporator coils as a design option; however, during interviews, manufacturers indicated that larger evaporator coils were an effective design option to increase the efficiency of single-packaged dedicated systems. DOE gathered additional data on evaporator performance from the CCD and modeled improved evaporator coils as a design option for single-packaged dedicated systems. Details of DOE's analysis for this design option are discussed in chapter 5 of the accompanying TSD.

DOE also received no comments regarding improved evaporator motors. As stated previously, DOE's interpretation of the language in EPCA is that it prescribes the use of either ECMs or 3-phase motors (42 U.S.C. 6213(f)(1)(E)). As such, DOE did not evaluate improved evaporator motors in this NOPR analysis.

In response to the request for comment about liquid suction heat exchangers, AHRI, HTPG, Hussmann-Refrigeration, and Lennox suggested that DOE exclude liquid suction heat exchangers as a design option, since this technology does not always improve efficiency. (AHRI, No. 39 at p. 3; HTPG, No. 35 at p. 6; Hussmann-Refrigeration, No. 38 at p. 3; Lennox, No. 36 at p. 4) AHRI also commented that liquid suction heat exchangers are difficult to implement on units with higher AWEF. (AHRI, No. 39 at p. 3). AHRI-Wine recommended that heat exchangers should only be used for split systems when there may be liquid subcooling losses and low return gas temperatures. (AHRI-Wine, No. 39 at p. 4) DOE understands AHRI-Wine's comment to be in reference to liquid suction heat exchangers. As stated in the June 2022 Preliminary Analysis TSD, DOE does not have sufficient data on how liquid suction heat exchangers may impact performance or component lifetimes of walk-in refrigeration systems. *See* section 5.7.2.9 of chapter 5 of the June 2022 Preliminary Analysis TSD. Since DOE did not receive additional data from stakeholders in response to the June 2022 Preliminary Analysis, DOE did not analyze liquid suction heat exchangers as a design option in this NOPR analysis.

The Efficiency Advocates encouraged DOE to evaluate multiple-capacity and/or variable-speed compressors as design options.[32] (Energy Advocates, No. 37 at p. 2) However, KeepRite stated that using variable-capacity compressors does not automatically increase the efficiency and that the system must be designed to exploit the advantages provided by the variable-speed components. (KeepRite, No. 41 at p. 1) Additionally, KeepRite commented that compressor efficiency should be regulated at the compressor manufacturer level. (KeepRite, No. 41 at p. 2) In this NOPR analysis, DOE analyzed variable-capacity compressors for low- and medium-temperature refrigeration systems and assumed that the system was redesigned to take advantage of the variable-speed compressor. Specifically, DOE assumed that unit coolers paired with dedicated condensing units under analysis, and unit coolers contained within single-packaged dedicated systems under analysis, had on-cycle two-speed capabilities. However, DOE did not analyze on-cycle variable-speed evaporator fan controls as an independent design option because not all unit coolers would be paired with condensing systems that could vary the cooling load to take advantage of on-cycle variable-speed evaporator fans. Details of the variable-capacity compressor design option implementation in this NOPR analysis can be found in chapter 5 of the accompanying TSD.

HTPG commented that it disagrees with DOE's statement that the air-side heat transfer characteristics of coils could be improved by decreasing the spacing between the fins because there could be potential negative impacts, such as increased fouling, clogging of the coil on condensers, frost accumulation, and blockage on evaporator coils. (HTPG, No. 35 at p. 2) DOE acknowledges that decreased fin spacing can increase coil fouling or result in frost accumulation on low-temperature evaporator units that would negatively affect unit operation. As such, when DOE evaluated improved condenser and evaporator coils in this NOPR, it maintained a constant fins per inch between baseline and improved coils.

KeepRite commented that efficiency gains from higher efficiency condenser fan motors are limited because motors are already regulated for efficiency. (KeepRite, No. 41 at p. 2) Through market research and manufacturer feedback, DOE has tentatively determined that most baseline condenser fan motors are permanent split capacity-type motors; however, DOE has found some dedicated condensing unit fans models that utilize more efficient ECMs. Therefore, DOE has tentatively determined that higher efficiency condenser fan motors are a feasible design option.

AHRI requested clarification on whether two-speed fans are considered in DOE's analysis and whether they fall under the same requirements as variable-speed fans. (AHRI, No. 39 at p. 2) Hussmann-Refrigeration reiterated AHRI's comment seeking clarification on variable- and multiple-speed fans. (Hussmann-Refrigeration, No. 38 at p. 2) Lennox commented that it considers the scope of technologies DOE has evaluated to be appropriate; however, it suggested that DOE consider variable-speed condenser fan control. (Lennox, No. 36 at p. 2) Furthermore, Lennox stated that two- or multiple-speed condenser fans could be considered as a potential subset of full variable-speed condenser fans. *Id.* DOE is interpreting AHRI and Hussmann-Refrigeration's comments to be asking for clarification about the variable-speed condenser fan design option. In the June 2022 Preliminary Analysis, DOE considered only fully variable-speed, not two-speed, condenser fan motors as a design option. Through manufacturer interviews and its own analysis, DOE has tentatively determined that fully variable-speed fans are more effective at increasing a unit's efficiency than two-speed fans. Furthermore, based on an analysis of ECM prices, DOE has tentatively determined that the cost for variable- and two-speed ECMs are similar. Therefore, DOE did not include two-speed condenser fans as an intermediate design option in its NOPR analysis. DOE notes that it has chosen what it considers to be the most realistic design path in its NOPR analysis, however, the design options evaluated by DOE should not be interpreted as prescriptive requirements but rather possible steps along a potential efficiency improvement path.

KeepRite stated that efficiency gains from implementing a variable-speed condenser fan are limited by the lowered head pressure setting that many units already implement to reach baseline and that many units already use this type of fan. (KeepRite, No. 41 at p. 2) DOE notes that it received multiple comments suggesting that dedicated condensing units already use the lowest reliable head pressure setting to meet baseline efficiency levels. These comments are addressed in the baseline efficiency subsection of section IV.C.1.d. DOE acknowledges that there is limited potential for variable-speed condenser fans to save energy when a unit's head pressure has already been lowered and DOE considers the relationship between variable-speed condenser fans and a unit's head pressure setting in its analysis. Based on manufacturer interview feedback, DOE has tentatively determined that very few or no baseline walk-in refrigeration systems use variable-speed condenser fans. Rather, variable-speed condenser fans are an optional extra for additional control or efficiency that consumers can specify at an additional cost.

KeepRite also commented that no real energy savings would occur from

[32] Multiple-capacity compressors have three or more distinct capacities at which they can operate. Variable-capacity or variable-speed compressors have a range of capacities in which they can operate at any given speed.

ambient subcooling because it is already realized in the liquid line of a typical installation, and because ambient subcooling decreases the overall condensing area of the unit resulting in an increase in energy consumption. (KeepRite, No. 41 at p. 2) In this NOPR analysis, DOE implemented the ambient subcooling design option by assuming that condenser face area is added to a coil to make an ambient subcooling circuit, rather than re-circuiting a portion of the existing heat exchanger condensing area to ambient subcooling. Based on its analysis, DOE has tentatively determined that increased liquid line subcooling does increase system efficiency. As such DOE, is analyzing ambient subcooling as a design option for walk-in refrigeration systems.

AHRI-Wine stated that smaller-sized high-temperature units can maximize liquid subcooling entering the expansion valve without having a dedicated liquid subcooling section in the condenser coil. (AHRI-Wine, No. 39 at p. 6) Additionally, AHRI-Wine commented that it seeks clarification on if the ambient subcooling design option is defined by a specific subcooling target. *Id.* DOE understands that smaller-sized high-temperature units can maximize subcooling without having a dedicated liquid subcooling section, however, based on its analyses, DOE has found that an additional subcooling circuit does result in efficiency increases for all walk-in refrigeration systems. DOE is therefore maintaining ambient subcooling as a design option for all outdoor dedicated condensing units and outdoor single-packaged dedicated systems. Furthermore, DOE clarifies that in this NOPR analysis, the subcooling achieved through the addition of an ambient subcooling circuit is based on a specified subcooling target determined consistent with manufacturer interview feedback. The details of the ambient subcooling design option are further discussed in chapter 5 of the accompanying TSD.

AHRI-Wine commented that wine cellar manufacturers seek further clarification on the head pressure design options: (1) If fixed head pressure is regulated by adding a head pressure control valve to the system for hot gas bypass; (2) if floating head pressure means a condenser that drops head pressure as a function of the ambient [temperature] with no external controls; and (3) if fan speed regulation is categorized as fan speed reduction or fan cycling based on head pressure. (AHRI-Wine, No. 39 at p. 6) DOE assumes that in a system without floating head pressure controls (''fixed head pressure''), there would be no head pressure controls. This includes passive or active controls that would allow head pressure reductions at lower ambient temperatures. For systems with floating head pressure, DOE assumes the system would be equipped with a valve or a set of valves that would enable refrigerant gas to bypass the condenser coil and allow the system head pressure to float down at lower ambient temperatures. In this NOPR, DOE implemented two condenser fan control options: cycling fans and variable-speed fans. DOE assumed cycling condenser fans would cycle on and off at low ambient temperature to reduce fan power. DOE assumed that variable-speed fan controls were combined with appropriate motors and would reduce the fan's speed at lower ambient temperature to reduce fan power. The details of DOE's implementation of floating head pressure controls and condenser fan controls can be found in chapter 5 of the accompanying TSD.

KeepRite commented that crankcase heaters use a small fraction of the energy used for compressors and fans and stated that controlling the crankcase heaters would only save a portion of that small fraction of energy. (KeepRite, No. 41 at p. 2) KeepRite added that some crankcase heater controls can reduce efficiency due to the current test procedure calculations. *Id.* DOE has tentatively determined that although crankcase heaters use less energy than other system components, crankcase heater controls can still reduce energy use of walk-in refrigeration units when tested according to the current test procedure in accordance with appendix C1.

AHRI-Wine recommended that DOE consider 0.5-inch, R–2 insulation or equivalent for baseline thermal insulation and 1.5-inch, R–6 insulation, or equivalent, for the increased thermal insulation design options. (AHRI-Wine, No. 39 at p. 6) DOE considered this recommendation and data collected through high-temperature unit teardowns and has reduced the thermal insulation thickness for high-temperature units to be consistent with AHRI-Wine's recommendation. This is consistent with DOE's acknowledgment of the size-sensitive nature of the high-temperature walk-in market, as thermal insulation thicker than 1.5 inches would not be practical in many high-temperature applications.

During manufacturer interviews conducted prior to this NOPR analysis, some manufacturers indicated that improvements to condenser fan blades did not effectively increase walk-in refrigeration system efficiency. DOE analyzed evaporator fan data as a proxy for condenser fan data and found no correlation between evaporator fan designs and evaporator efficiency. Based on the manufacturer interview feedback and the fan data analysis, DOE has tentatively determined that improving fan blade designs has no measurable effect on AWEF2 values. As such, DOE is not including improved condenser fan blades as a design option in this NOPR analysis.

In summary, the dedicated condensing unit and single-packaged dedicated systems design options analyzed in this NOPR, and the equipment classes that they apply to, are listed in Table IV.16.

TABLE IV.16—NOPR ANALYSIS REFRIGERATION SYSTEM DESIGN OPTIONS

	Dedicated condensing units	Single-packaged dedicated systems
All Units	• Higher efficiency compressors • Improved condenser coil • Higher efficiency condenser fan motors	• Higher efficiency compressors. • Higher efficiency condenser fan motors. • Off-cycle evaporator fan control. • improved thermal insulation.
Outdoor Units Only	• Crankcase heater controls • Variable-speed condenser fan control • Ambient subcooling • Head pressure controls	• Crankcase heater controls. • Variable-speed condenser fan control. • Ambient sub-cooling. • Head pressure controls.
Medium- and Low-Temperature Units Only		• Improved evaporator and condenser coil. • Hydrocarbon refrigerants.

Baseline Efficiency

For each equipment class, DOE generally selects a baseline model as a reference point for each class, and measures changes resulting from potential energy conservation standards against the baseline. The baseline model in each equipment class represents the characteristics of an equipment typical of that class *(e.g.,* capacity, physical size). Generally, a baseline model is one that just meets current energy conservation standards, or, if no standards are in place, the baseline is typically the most common or least efficient unit on the market.

In the June 2022 Preliminary Analysis, DOE set baseline efficiency levels for currently covered dedicated condensing units using the applicable minimum energy conservation standard. *See* 10 CFR 431.306. For equipment classes that were not analyzed in previous walk-in rulemakings (*e.g.,* single-packaged dedicated systems, high-temperature single-packaged dedicated systems), DOE used product catalogs, feedback from manufacturer interviews, and testing to set the baseline at the lowest efficiency level commonly seen on the market today.

The Efficiency Advocates requested clarification on the discrepancy between the baseline AWEF ratings in the engineering analysis and the current standards, stating that some dedicated condensing units in the June 2022 Preliminary Analysis have baseline efficiency levels both below and above the current standard levels. (Efficiency Advocates, No. 37 at pp. 4–5) HTPG commented that no representative unit of single-packaged dedicated systems meets the minimum AWEF of 7.6 for dedicated condensing systems after all design options are applied. (HTPG, No. 35 at p. 3)

In the June 2022 Preliminary Analysis, DOE set baseline efficiency levels for dedicated condensing units with energy conservation standards at the current minimum standard level using the appendix C test procedure (*see* appendix C to Subpart R to 10 CFR 431). For example, for a medium-temperature, outdoor dedicated condensing unit, DOE determined which technology options would just meet the current AWEF standard of 7.6 Btu/W-h using the appendix C test procedure. Once units had their baseline design options set, DOE conducted the rest of the efficiency analysis using the appendix C1 test procedure to determine AWEF2 values for each efficiency level, including baseline. DOE notes that in the June 2022 Preliminary Analysis, efficiency value was labeled as ''AWEF,'' however, all efficiency values calculated in accordance with the appendix C1 test procedure were AWEF2 values, as defined in the appendix C1.

Among other updates, appendix C1 includes additional off-cycle power measurements and accounts for single-packaged dedicated system thermal losses that are not included in appendix C. Therefore, the AWEF2 of a given representative unit tends to be lower than the AWEF for the same unit, which explains why AWEF2 for some baseline units was below current AWEF standards in the June 2022 Preliminary Analysis. Single-packaged dedicated system AWEF2 values are generally more affected by the test procedure changes since appendix C1 accounts for thermal loss. As observed by HTPG, this could mean that even with all design options added, many single-packaged dedicated unit AWEF2 values do not meet current AWEF standards. DOE notes that the tested AWEF values for these units would meet the current AWEF standards. In contrast, some baseline dedicated condensing units did not require any additional design options to meet the current standard level. Using the appendix C1 test procedure, these baseline dedicated condensing units exceed the current standards.

In this NOPR analysis, DOE maintained the June 2022 Preliminary Analysis baseline approach and set baseline efficiency levels for dedicated condensing systems analyzed in previous rulemakings by determining the combination of design options using the appendix C test procedure necessary to meet the current applicable minimum energy conservation standards for AWEF.

AHRI-Wine suggested that DOE consider hermetic compressors for all wine cellar units with a capacity less than 9,000 Btu/h. (AHRI-Wine, No. 39 at p. 5) Based on feedback from high-temperature refrigeration manufacturers and a review of compressor catalogs, DOE has tentatively determined that high-temperature rotary compressors are readily available and are commonly used in high-temperature refrigeration systems above 5,000 Btu/h. DOE therefore assumed that the 7,000 Btu/h representative units would use a rotary compressor at baseline for this NOPR analysis. Consistent with AHRI-Wine's recommendation and DOE's review of product catalogs, DOE assumed hermetic compressors are used in 2,000 Btu/h high-temperature single-packaged dedicated systems at baseline.

In response to the June 2022 Preliminary Analysis baseline discussion, HTPG commented that baseline for dedicated condensing units should include floating head pressure since many condensing units on the market utilize this design option to meet the current minimum AWEF. (HTPG, No. 35 at p. 5) AHRI commented that in the June 2022 Preliminary Analysis, DOE assumed a higher head pressure than what is typically seen on the market. (AHRI, No. 39 at p. 2). KeepRite stated that most units include a lower head pressure setting and any further reduction could have adverse effects and reduce operating efficiency. (KeepRite, No. 41 at pp. 1–2) Furthermore, KeepRite commented that flashing would occur from routing a liquid line through a warm area of a building unless the line is well insulated. *Id.* DOE found that manufacturers generally agreed with these statements during manufacturer interviews.

Based on stakeholder feedback, DOE has adjusted the baseline head pressure control design option to allow head pressure to float down to 150 pounds per square inch. Additionally, DOE assumed that liquid lines would be well insulated if routed through warm areas of a building. Details of DOE's procedure for determining baseline for each representative unit and modeling of head pressure controls are discussed in chapter 5 of the accompanying TSD.

Higher Efficiency Levels

Consistent with the analysis for previous walk-in refrigeration system rulemakings (*i.e.,* The June 2014 Final Rule and the July 2017 Final Rule), in the June 2022 Preliminary Analysis, DOE added the remaining applicable design options to each representative unit to determine efficiency levels above baseline. As discussed in the design option section, the increase in AWEF2 from each design option for each representative unit is calculated using appendix C1 and is calibrated using test data, stakeholder comments, and manufacturer interview feedback.

In section ES.4.4 of the June 2022 Preliminary Analysis TSD, DOE requested comment on the efficiency levels that it evaluated.

Hussmann-Refrigeration commented that efficiency levels beyond the baseline may not be attainable because many of the technology options that DOE considered in the June 2022 Preliminary Analysis are already being implemented to achieve the current minimum AWEF. (Hussmann-Refrigeration, No. 38 at p. 2) Based on its analysis, DOE notes that while most or all available design options are necessary to meet the baseline efficiency level for some representative units, other representative units can achieve efficiencies higher than baseline with the application of the evaluated design options. DOE has validated its results through its own walk-in refrigeration system testing. Additionally, DOE's performance modeling of each design option in this analysis was developed with manufacturer feedback through manufacturer interviews. DOE has tentatively determined that the results of this analysis are representative of the units and technology currently available on the market and has therefore adopted the June 2022 Preliminary Analysis efficiency level approach in this NOPR.

The Efficiency Advocates questioned why no meaningful energy savings occur for efficiency levels (corresponding to the variable-speed condensing fan, ambient subcooling, and self-regulated crankcase heater control design options) above the baseline for the smallest representative unit for medium-temperature, outdoor, dedicated condensing units. (Efficiency Advocates, No. 37 at p. 2) The June 2022 Preliminary Analysis showed that the variable-speed condensing fan and ambient subcooling design options were less effective at improving the energy efficiency of smaller capacity units. Additionally, the self-regulated crankcase heater control design option reduced energy consumption and improved efficiency by only a small amount for all equipment classes. As such, these design options did not meaningfully improve the AWEF2 or reduce the energy consumption of the 9,000 Btu/h medium-temperature outdoor dedicated condensing representative unit. In this NOPR analysis DOE has revised its assumptions for these three design options based on manufacturer feedback received during interviews. With these modifications, these design options become more effective than what DOE presented in the June 2022 Preliminary Analysis. Details of DOE's revised assumptions for these design options are discussed in chapter 5 of the accompanying TSD.

AHRI-Wine commented that wine cellar manufacturers already optimize their units for efficiency, including heat exchanger coils with high density corrugated fins, rifled tubing, and circuiting optimized for specific operating points for wine cellar applications. (AHRI-Wine, No. 39 at p. 4) AHRI-Wine also stated that it may be difficult for wine cellar manufacturers to reach higher efficiency levels because fewer technology options are available for smaller capacity units. (AHRI-Wine, No. 39 at p. 3) Based on its analysis for this NOPR, DOE has tentatively concluded that there are design options that can be applied to baseline high-temperature units to improve their efficiency, such as electronically commutated condenser fan motors and crankcase heater controls. DOE also notes that several design options considered for medium- and low-temperature dedicated condensing units and single-packaged dedicated systems are not being considered for high-temperature systems in this analysis, such as improved condenser and evaporator coils. Table IV.16 in the Design Options subsection of section IV.C.1.d shows the design options that apply to all units, including high-temperature units, and to medium- and low-temperature units only.

For the June 2022 Preliminary Analysis, DOE developed correlations between fan power and the nominal capacity for units with different temperature and ducting configurations. *See* section 5.5.5.4 of chapter 5 of the June 2022 preliminary TSD. In response to this analysis, AHRI requested clarification on DOE's approach for using fan watts as a function of nominal capacity and external static pressure. (AHRI, No. 39 at p. 2) In this NOPR analysis, DOE built fan power models similar to those presented in the June 2022 Preliminary Analysis. These models are based on either unit capacity (from product catalogs and testing) or the ratio of condenser load to condenser temperature difference (from testing) and external static pressure for ducted units (from manufacturer's requests for waivers submitted to DOE).[33] These models and the data they are based on are discussed in more detail in chapter 5 of the accompanying TSD.

AHRI commented that reliability issues with maximum technology options could prove the maximum technology options to be unfeasible. (AHRI, No. 39 at p. 2) As previously discussed, the purpose of DOE's screening analysis is to remove technology options that may have a negative impact on equipment utility; therefore, DOE has tentatively determined that application of any design option, including all maximum technology design options, would not have a negative impact on equipment utility. The Efficiency Advocates commented that DOE should ensure that the maximum technology efficiency levels are at least equivalent to the most efficient products on the market and pointed to certified models with AWEFs that exceed the maximum technology level in the June 2022 preliminary TSD for multiple walk-in refrigeration equipment classes. (Efficiency Advocates, No. 37 at p. 5) DOE notes that the engineering analysis is based on design options that DOE has identified as available on the market and has shown, through analysis and/or testing, to increase dedicated condensing unit and/or single-packaged dedicated system efficiency. DOE has tentatively concluded that some of the higher AWEF values reported in CCD are either not feasible or are not representative of the maximum technology options attainable for the entire market. This means that maximum technology AWEF2 values in this analysis may not reach the maximum AWEF levels in the CCD for some refrigeration equipment classes. The CCD efficiency distribution is discussed in detail in chapter 3 of the accompanying TSD.

The specifics of modeling each design option are discussed in chapter 5 of the accompanying TSD.

e. Unit Coolers

Refrigerants Analyzed

In the June 2022 Preliminary Analysis, DOE assumed R–404A in its analysis of medium- and low-temperature unit coolers and assumed R–134A in its analysis of high-temperature unit coolers. *See* section 2.4.3.2 of chapter 2 of the June 2022 Preliminary Analysis TSD. DOE requested comment on whether the refrigerants it used in its analysis are representative of the current and future walk-in market in section ES.4.8 of the preliminary analysis TSD.

In response, HTPG commented that it agrees with DOE using R–404A in its analysis of medium- and low-temperature unit coolers. (HTPG, No. 35 at p. 6) AHRI-Wine commented that wine cellar manufacturers agree with DOE using R–134A for high-temperature unit coolers in the June 2022 Preliminary Analysis. (AHRI-Wine, No. 39 at p. 5)

As discussed in section IV.C.1.d, there is an upcoming December 2022 AIM NOPR that, if adopted as proposed, would require the use of lower GWP refrigerants for walk-in coolers and freezers. DOE notes that the primary concern about the transition to lower GWP refrigerants relative to the performance of refrigeration systems is the potential for higher refrigerant glide. As discussed in section IV.C.1.d of this document, glide has a differential impact for walk-in refrigeration systems since dedicated condensing units and

[33] CellarPro Decision and Order, 86 FR 23702 (May 4, 2021); Air Innovations Decision and Order, 86 FR 26504 (May 14, 2021); Vinotemp Decision and Order, 86 FR 36732 (July 13, 2021); LRC Coil Interim Waiver 86 FR 47631 (Aug. 26, 2021).

unit coolers are tested and rated separately. Increased refrigerant glide can decrease condensing unit performance, however, increased refrigerant glide does not decrease unit cooler performance. As such, there is limited concern that unit coolers would not be able to meet a proposed standard should the proposals in the December 2022 AIM NOPR be finalized. DOE is therefore basing its unit cooler NOPR analysis on the same refrigerants that it analyzed in the June 2022 Preliminary Analysis—R–404A for medium- and low-temperature unit coolers and R–134A for high-temperature unit coolers.

Representative Units

As discussed in section 5.3.3 of the June 2022 Preliminary Analysis TSD, DOE analyzed the representative units listed in Table IV.17.

TABLE IV.17—REPRESENTATIVE UNITS ANALYZED FOR UNIT COOLERS IN THE JUNE 2022 PRELIMINARY ANALYSIS

Temperature	Class code	Capacity
High	UC.H	9,000 25,000
Medium	UC.M	9,000 25,000
Low	UC.L	9,000 25,000

DOE requested comment on the representative units analyzed in section ES.4.5 of the June 2022 Preliminary Analysis TSD. HTPG commented that DOE should consider analyzing additional representative units to provide a broader range of capacities to help set standards as a function of capacity. (HTPG, No. 35 at p. 5) Specifically, HTPG recommended analyzing medium- and low-temperature unit coolers at 75,000 and 175,000 Btu/h. (*Id.*) AHRI also requested that DOE consider larger capacity representative units (also recommended in their comment to the WICF TP NOPR [34]), such as 72,000 Btu/h for unit coolers. (AHRI, No. 39 at pp. 2–3) Hussmann-Refrigeration and Lennox stated that they agree with AHRI's request for a larger capacity representative unit at 72,000 Btu/h for unit coolers. (Hussmann-Refrigeration, No. 38 at p. 3; Lennox, No. 36 at pp. 3–4) AHRI also recommended that DOE analyze ducted and non-ducted high-temperature unit coolers with capacities of 2,000 Btu/h, 9,000 Btu/h, and 25,000 Btu/h. (AHRI, No. 39 at p. 2)

[34] See Docket No. EERE–2017–BT–TP–0010–0022.

For this NOPR analysis, DOE identified additional representative units for the medium- and low-temperature equipment classes based on stakeholder comments combined with the common units certified in the CCD. Specifically, DOE has added 3,000 Btu/h, 54,000 Btu/h, and 75,000 Btu/h representative capacities for medium- and low–temperature unit coolers. DOE has tentatively concluded that for walk-in applications (total chilled storage area of less than 3,000 square feet), unit cooler capacities would not exceed 75,000 Btu/h and therefore did not include a representative unit above 75,000 Btu/h. Similarly, DOE identified representative units for the high-temperature equipment classes based on stakeholder comments and a review of manufacturer literature. Ultimately, DOE has included ducted high-temperature unit coolers at 9,000 Btu/h and 25,000 Btu/h in this NOPR analysis.

The unit cooler representative units analyzed in this NOPR analysis are listed in Table IV.18.

TABLE IV.18—REPRESENTATIVE UNITS ANALYZED FOR UNIT COOLERS

Temperature	Class code	Capacity (Btu/h)
High (Non-Ducted)	UC.H	9,000 25,000
High (Ducted)	UC.H.D	9,000 25,000
Medium	UC.M	3,000 9,000 25,000 54,000 75,000
Low	UC.L	3,000 9,000 25,000 54,000 75,000

Efficiency Levels

In the June 2022 Preliminary Analysis, DOE defined efficiency levels using the design option approach. *See* section 5.2 of chapter 5 of the June 2022 Preliminary Analysis TSD.

In response to DOE's design options analysis, Lennox commented that it believes the potential for efficiency increases based on design options for evaporator coils and heat exchangers are relatively small and that improvements in evaporator coils should be cost-justified because they are capital intensive. (Lennox, No. 36 at p. 4) DOE notes that in the engineering analysis, it considers both the efficiency and cost increases for each design option. These costs and efficiency gains are further analyzed in the downstream analyses where manufacturer capital expenditure is evaluated relative to potential standard levels. For more details on this analysis, see section IV.J of this document.

Additionally, DOE received comments from stakeholders pertaining to the improved evaporator fan blade design option considered in section 5.7.2.4 of chapter 5 of the June 2022 Preliminary Analysis. Lennox commented that, based on its own experience, changing the evaporator fan blade does not increase a unit's efficiency. (Lennox, No. 36 at p. 3) AHRI commented that it believes changing fan blades would result in only minimal energy gains. (AHRI, No. 39 at p. 2) In the manufacturer interviews that DOE conducted, most manufacturers agreed that improving evaporator fan blades has no measurable effect on unit cooler efficiency. Based on this feedback, DOE assumed that fans with improved blades were not an effective design option for improving the efficiency of walk-in refrigeration systems in this NOPR analysis.

KeepRite commented that applying variable-speed evaporator fans can save energy during low load operation; however, since the system will run at a lower efficiency, the system must be designed to modulate the cooling capacity. (KeepRite, No. 41 at p.1) DOE notes that in the June 2022 Preliminary Analysis, variable-speed evaporator fans were only analyzed as a design option for reducing off-cycle unit cooler fan power. DOE did not consider variable-speed fan controls that adjust the evaporator fan speed during the compressor on-cycle since on-cycle variable-speed evaporator fan control requires pairing to a condensing system that can modulate the cooling load sent to the evaporator to effectively save energy, and there is no guarantee that unit coolers will be paired with such condensing systems in the field. *See* section 5.7.2.7 of chapter 5 of the June 2022 Preliminary Analysis TSD. In this NOPR analysis, DOE is not considering variable-speed evaporator fans as a design option to improve efficiency.

The Efficiency Advocates requested clarification on why no meaningful energy savings occur when implementing a variable-speed evaporator fan and improved fan blades for low-temperature unit coolers. (Efficiency Advocates, No. 37 at p. 2) DOE notes that both the calculated AWEF and estimated energy consumption of low-temperature unit coolers include evaporator fan power, defrost power, estimated system power, and any ancillary power. Evaporator fan power makes up a limited proportion of the total energy a unit cooler consumes.

As such, design options that provide relatively small energy improvements relative to the overall energy use of a unit cooler (like improved evaporator fan blades and variable-speed evaporator fan controls) will have minimal impact on overall energy savings and reduction in AWEF.

HTPG stated that it disagrees with DOE's design option analysis approach, since DOE did not recognize that most baseline units already include improved evaporator fan blades and variable-speed evaporator fans. (HTPG, No. 35 at pp. 2–5) Furthermore, HTPG commented that it does not believe unit cooler efficiency levels should be increased because the remaining technology options, excluding improved fan blades and variable-speed fans, would result in no efficiency increases. (*Id.*)

DOE notes that in the June 2022 Preliminary Analysis, there were some unit cooler representative units that just met baseline with all design options, including improved fan blades and variable-speed fans, applied; however, DOE found that some units in the CCD at each representative capacity for medium- and low-temperature unit coolers are rated at a higher efficiency than baseline. Therefore, DOE has tentatively determined that the efficiency level of unit coolers could be increased beyond the current energy conservation standards.

Based on additional market research and stakeholder comments, DOE switched to an efficiency level approach for medium- and low-temperature unit coolers in this NOPR analysis. DOE has tentatively determined that this approach results in more accurate cost-efficiency curves, which are directly informed by the unit cooler market. To conduct this analysis, DOE constructed a database of medium- and low-temperature unit coolers by combining CCD data and manufacturer product literature. Throughout this notice, this database is referenced as ''the unit cooler performance database.'' The efficiency levels evaluated in this NOPR analysis for medium- and low–temperature units are not defined using design options but are based on the unit cooler performance database.

In the June 2022 Preliminary Analysis, DOE observed that in the unit cooler performance database there was a group of low- and medium-temperature unit coolers with ratings at what appears to be a constant offset above the current standards. See section 3.2.4.4 in chapter 3 of the preliminary TSD. In response to DOE's finding, HTPG commented that DOE should be able to determine the constant offset that low- and medium-temperature unit coolers are rated above the current standards from product literature because disclosure of efficiency information in marketing materials is required by title 10 Code of Federal Regulations Part 431.305 Walk-in cooler and walk-in freezer labeling requirements. (HTPG, no. 35 at p. 2) DOE was not able to find product literature or marketing materials for the units in question and therefore was not able to confirm the AWEF ratings for this group of unit coolers certified in the CCD and did not consider them in its analysis. The most recent CCD efficiency distribution is discussed in more detail in chapter 3 of the accompanying TSD.

Not including the group of unit coolers with ratings at what appear to be a constant offset above the current standards, the current CCD includes few unit coolers rated above baseline. However, after evaluating certified unit cooler capacities, DOE has tentatively determined that there are unit coolers on the market at efficiencies higher than baseline. As such, instead of modeling efficiency based on certified AWEF values, DOE calculated unit cooler AWEF in accordance with appendix C to subpart R using certified capacity, catalog fan power, and default defrost power calculations. Using the unit cooler performance database, DOE found that the primary design option in unit coolers on the market today to improve efficiency is an improved evaporator coil. Specifically, DOE found that adding tube rows to unit cooler evaporators increases capacity while keeping fan power constant, resulting in more efficient units.

DOE was unable to construct a performance database for high-temperature unit coolers since there are no high-temperature units certified in the CCD; therefore, DOE conducted a design option approach for high-temperature unit coolers. As discussed in section IV.B.2.b of this document, the design options remaining for unit coolers after screening are improved evaporator coil, improved evaporator fan blades, off-cycle evaporator fan control, and on-cycle evaporator fan control. As discussed previously in this section, DOE has tentatively determined that improved evaporator fan blades do not effectively improve unit cooler efficiency, and therefore DOE did not analyze improved evaporator fan blades as a design option for high-temperature unit coolers. Additionally, on-cycle evaporator fan control requires a condensing system that varies cooling load to the unit cooler and DOE is aware that not all high-temperature condensing systems are capable of this type of operation. As a result, DOE did not analyze on-cycle evaporator fan control as a design option for high-temperature unit coolers. The remaining design options for high-temperature unit coolers are improved evaporator coils and off-cycle evaporator fan controls.

Details on DOE's methods for defining baseline efficiency and efficiency levels above baseline are discussed in the following sections and in more detail in Ch. 5 of the accompanying TSD.

Baseline Efficiency

For each equipment class, DOE generally selects a baseline model as a reference point for each class, and measures changes resulting from potential energy conservation standards against the baseline. The baseline model in each equipment class represents the characteristics of equipment typical of that class (*e.g.,* capacity, physical size). Generally, a baseline model is one that just meets current energy conservation standards, or, if no standards are in place, the baseline is typically the most common or least efficient unit on the market.

As discussed in section 5.6.3 of the June 2022 Preliminary Analysis TSD, DOE assumed that a baseline medium- or low-temperature unit would just meet the current energy conservation standards (*see* 10 CFR 431.306). The analysis in the June 2022 Preliminary Analysis evaluated which design option combinations would be needed to achieve the current standards.

In response to this baselining approach, AHRI commented that DOE did not consider in its analysis that many manufacturers are already using variable-speed technology in their unit coolers. (AHRI, No. 39 at p. 2). KeepRite commented that most unit coolers include off-cycle fan control to meet the current standards. (KeepRite, No. 41 at p. 2) HTPG stated that it believes baseline unit coolers should include improved evaporator fan blades and variable-speed evaporator fans. (HTPG, No. 35 at p.5) KeepRite stated that enhanced tubing and fin surfaces are already found in most evaporator and condenser coils. (KeepRite, No. 41 at p. 2)

DOE acknowledges that many baseline medium- and low-temperature unit coolers use variable-speed fans, improvements to fan blades, and optimized heat exchanger coils. While constructing the unit cooler performance database for this NOPR analysis, DOE found that all units included in the database used two-speed ECMs. DOE made no assumptions about baseline unit cooler technologies while constructing this database since the performance benefits of different technologies should be apparent from the fan power and capacities of the unit. DOE found that baseline medium- and low-temperature unit coolers with a capacity less than 25,000 Btu/h typically had two evaporator rows and baseline units with a capacity greater than 25,000 Btu/h typically had three evaporator tube rows. Table IV.19 lists representative units and the number of baseline evaporator tubes DOE used in its analysis.

TABLE IV.19—BASELINE MEDIUM- AND LOW-TEMPERATURE UNIT COOLER EVAPORATOR TUBE ROWS

Temperature	Capacity (Btu/h)	Baseline evaporator tube rows
Medium	3,000	2
	9,000	2
	25,000	2
	54,000	3
	75,000	3
Low	3,000	2
	9,000	2
	25,000	2
	54,000	3
	75,000	3

There are currently no energy conservation standards for high-temperature unit coolers; therefore, DOE could not use a current standard as the baseline for the high-temperature equipment classes. Instead, DOE used manufacturer literature to select baseline units that DOE has tentatively determined are representative of the baseline efficiency currently on the market. DOE determined potential design options applied to these units based on a review of manufacturer literature and feedback from high-temperature refrigeration system manufacturers. DOE validated the AWEF values used to define the high-temperature baseline efficiency level through investigative testing.

Maximum Technology Levels

In the June 2022 Preliminary Analysis, DOE defined the maximum technology unit cooler as a unit cooler that includes all analyzed design options. *See* chapter 5 of the June 2022 Preliminary Analysis TSD. As discussed in the Efficiency Levels subsection of section IV.C.1.e of this document, the baseline and maximum technology efficiency levels are the same for some unit coolers. However, DOE's reevaluation using the unit cooler performance database indicates that unit coolers at efficiencies higher than baseline are currently available in the market.

To set the maximum technology level for medium- and low–temperature unit coolers in its NOPR analysis, DOE selected the highest efficiency unit cooler available for each representative capacity from the unit cooler performance database. As discussed previously, the highest efficiency unit coolers at each representative capacity corresponded to an increase in two evaporator tube rows. Table IV.20 lists the unit cooler representative units evaluated in the NOPR and the number of tubes used to reach the highest efficiency level.

TABLE IV.20—MAXIMUM TECHNOLOGY MEDIUM- AND LOW-TEMPERATURE UNIT COOLER EVAPORATOR TUBE ROWS

Temperature	Capacity (Btu/h)	Maximum technology evaporator tube rows
Medium	3,000	4
	9,000	4
	25,000	4
	54,000	5
	75,000	5
Low	3,000	4
	9,000	4
	25,000	4
	54,000	5
	75,000	5

For the high-temperature unit cooler analysis, DOE maintained the approach it used in the June 2022 Preliminary Analysis. Specifically, it defined the maximum technology level as a representative unit with all the design options applied. As discussed in the unit cooler Efficiency Levels subsection of section IV.C.1.e of this document, the design options analyzed for high-temperature unit coolers were off-cycle evaporator fan controls and improved evaporator coils. In this NOPR, a maximum technology high-temperature unit cooler includes both design options.

Defining maximum technology levels for unit coolers is discussed in more detail in chapter 5 of the accompanying TSD.

Intermediate Efficiency Levels

All medium- and low-temperature unit cooler representative capacities had baseline and maximum technology efficiency levels that differed by more than one tube row. DOE defined an efficiency level for each of these representative units at the number of tube rows between their baseline and maximum technology levels. For example, if the baseline has three tube rows and the maximum technology had five tube rows, DOE defined an intermediate efficiency level at four tube rows. DOE's analysis of the market suggested that manufacturers only use full tube rows and therefore, DOE only used whole number tube rows for the analysis. DOE determined the efficiency of these intermediate efficiency levels using data from the unit cooler performance database. DOE did not define intermediate efficiency levels for high-temperature unit coolers.

Defining and determining the efficiency of intermediate efficiency levels is discussed in more detail in chapter 5 of the accompanying TSD.

2. Cost Analysis

The cost analysis portion of the engineering analysis is conducted using one or a combination of cost approaches. The selection of cost approach depends on a suite of factors, including the availability and reliability of public information, characteristics of the regulated product, and the availability and timeliness of purchasing the equipment on the market. The cost approaches are summarized as follows:

• *Physical teardowns:* Under this approach, DOE physically dismantles a commercially available product, component-by-component, to develop a detailed bill of materials for the product.

• *Virtual teardowns:* In lieu of physically deconstructing a product, DOE identifies each component using parts diagrams and spec sheets (available from manufacturer websites or appliance repair websites, for example) to develop the bill of materials for the product.

• *Price surveys:* If neither a physical nor catalog teardown is feasible (for example, for tightly integrated products such as fluorescent lamps, which are infeasible to disassemble and for which parts diagrams are unavailable) or cost-prohibitive and otherwise impractical (*e.g.,* large commercial boilers), DOE conducts price surveys using publicly available pricing data published on major online retailer websites and/or by soliciting prices from distributors and other commercial channels.

In the present case, DOE conducted the analysis using physical teardowns supplemented with virtual teardowns.

As discussed in section IV.C.1 of this document, DOE identified the energy efficiency levels associated with walk-in components using testing, market data, and manufacturer interviews. Next, DOE selected equipment for the physical teardown analysis having characteristics of typical equipment on the market at the representative capacity. DOE gathered information from performing a physical teardown analysis to create detailed bill of materials (''BOMs''), which included all components and processes used to manufacture the equipment. DOE used the BOMs from the teardowns as inputs to calculate the manufacturer production cost (''MPC'') for equipment at various efficiency levels spanning the full range of efficiencies from the baseline to the maximum technology available.

During the development of the analysis for this NOPR, DOE held confidential interviews with manufacturers to gain insight into the walk-in industry and to request feedback on the engineering analysis. DOE used the information gathered from these interviews, along with the information obtained through the teardown analysis and public comments, to refine its MPC estimates for this rulemaking. Next, DOE derived manufacturer markups using data obtained for past walk-in rulemakings in conjunction with manufacturer feedback. The markups were used to convert MPCs into manufacturer sales prices (''MSPs''). Further information on comments received and the analytical methodology is presented in the following subsections. For additional detail, see chapter 5 of the NOPR TSD.

a. Teardown Analysis

To assemble BOMs and to calculate the manufacturing costs for the different parts of walk-in components, DOE disassembled multiple envelope and refrigeration system units into their base parts and estimated the materials, processes, and labor required for the manufacture of each individual part, a process referred to as a ''physical teardown.'' Using the data gathered from the physical teardowns, DOE characterized each part according to its weight, dimensions, material, quantity, and the manufacturing processes used to fabricate and assemble it.

DOE also used a supplementary method, called a ''virtual teardown,'' which examines published manufacturer catalogs and supplementary component data to estimate the major physical differences between equipment that was physically disassembled and similar equipment that was not. For supplementary virtual teardowns, DOE gathered equipment data such as dimensions, weight, and design features from publicly available information, such as manufacturer catalogs.

For parts fabricated in-house, the prices of the underlying ''raw'' metals (*e.g.,* tube, sheet metal) are estimated on the basis of 5-year averages to smooth out spikes in demand. Other ''raw'' materials such as plastic resins, insulation materials, etc. are estimated on a current-market basis. The costs of raw materials are based on manufacturer interviews, quotes from suppliers, and secondary research. Past results are updated periodically and/or inflated to present-day prices using indices from resources such as MEPS Intl.,[35] PolymerUpdate,[36] the U.S. geologic survey (''USGS''),[37] and the Bureau of Labor Statistics (''BLS'').[38]

More information regarding details on the teardown analysis can be found in chapter 5 of the NOPR TSD.

b. Cost Estimation Method

The costs of models are estimated using the content of the BOMs (*i.e.,* materials, fabrication, labor, and all other aspects that make up a production facility) to generate the MPCs. For example, these MPCs consider cost contributions from overhead and depreciation. DOE collected information on labor rates, tooling costs, raw material prices, and other factors as inputs into the cost estimates. For purchased parts, DOE estimated the purchase price based on volume-variable price quotations and detailed discussions with manufacturers and component suppliers. For fabricated parts, the prices of raw metal materials[39] (*i.e.,* tube, sheet metal) are estimated using the average of the most recent 5-year period. The cost of transforming the intermediate materials into finished parts was estimated based on current industry pricing at the time of analysis.[40]

c. Manufacturing Production Costs

DOE estimated the MPC at each efficiency level considered for each representative unit, from the baseline through the maximum technology and then calculated the percentages attributable to each cost category (*i.e.,* materials, labor, depreciation, and overhead). These percentages are used to validate the assumptions by comparing them to manufacturers' actual financial data published in annual reports, along with feedback obtained from manufacturers during interviews. DOE uses these production cost percentages in the MIA (see section IV.J).

In response to the June 2022 Preliminary Analysis, Hussmann-Doors commented that the manufacturer production costs used in the June 2022 Preliminary Analysis are about 30 percent lower for display, swinging, medium-temperature doors and 50 percent lower for display, swinging, low-temperature doors compared to its current door products. (Hussmann-Doors, No. 33 at p. 4) Hussmann-Doors also commented specifically on its display door frames, stating that its structures use a new material that was developed to meet the DOE energy requirements that were set in 2017 and that the material costs 1.5 times the cost of conventional materials on a per pound basis. (Hussmann-Doors, No. 33 at p. 4) Lennox commented that the MPC estimates are below current values. (Lennox, No. 36 at p. 4)

AHRI commented that it believes many assumptions for labor and time that contribute to MPCs are too low. (AHRI, No. 39 at p. 3) Hussmann-Refrigeration commented that it agrees with AHRI that the assumptions that contribute to MPCs are too low. (Hussmann-Refrigeration, No. 38 at p. 3) AHRI-Wine commented that it disagrees with the MPCs and MSPs due to the volatility of the market, supply chain issues, the dates that the efficiency standards will be implemented, and the volume of the wine cellar market. (AHRI-Wine, No. 39 at p. 4)

Based on stakeholder feedback, in preparing this NOPR DOE updated the labor costs that contribute to the MPC by increasing the hourly wages. Additionally, for refrigeration systems, DOE lowered the employee to supervisor ratio. DOE also sought feedback on costs during the most recent round of manufacturer interviews. DOE has incorporated the feedback received during these interviews and from stakeholder comments into its cost analysis for this NOPR. DOE has tentatively determined that the MPCs presented in this NOPR are representative of the current walk-in market.

d. Manufacturer Markup and Shipping Costs

To account for manufacturer non-production costs and profit margin, DOE applies a multiplier (the manufacturer markup) to the MPC. The resulting MSP is the price at which the manufacturer distributes a unit into commerce. DOE developed an average manufacturer markup by examining the annual Securities and Exchange Commission

[35] For more information on MEPS Intl, please visit: *www.meps.co.uk/*.

[36] For more information on PolymerUpdate, please visit: *www.polymerupdate.com*.

[37] For more information on the USGS metal price statistics, please visit *www.usgs.gov/centers/nmic/commodity-statistics-and-information*.

[38] For more information on the BLS producer price indices, please visit: *www.bls.gov/ppi/*.

[39] Fastmarkets, available at *www.fastmarkets.com/amm-is-part-of-fastmarkets*.

[40] U.S. Department of Labor, Bureau of Labor Statistics, Producer Price Indices, available at *www.bls.gov/ppi/*.

10–K reports filed by publicly traded manufacturers whose combined product range includes walk-ins. DOE also relied on data published in the June 2014 Final Rule and information gathered from manufacturer interviews to develop the initial manufacturer markup estimates. See chapter 12 of the NOPR TSD or section IV.J.2.d of this document for additional detail on the manufacturer markup.

In response to the MSPs, KeepRite commented that larger coils would result in higher installation and shipping costs. (KeepRite, No. 41 at p. 2)

DOE acknowledges that shipping costs account for additional non-production cost for manufacturers to distribute their equipment to the first buyer in the distribution chain. In this NOPR analysis, DOE estimated a per-unit shipping cost for each representative unit at each efficiency level based on the size and weight of the given unit. Design options such as larger condenser coils resulted in larger per unit shipping costs due to the increased size and weight associated with the design option. These shipping costs were incorporated into consumer prices. Installation costs are discussed in section IV.F.3 of this document.

3. Cost-Efficiency Results

The results of the engineering analysis are reported as cost-efficiency curves in the form of maximum daily energy consumption (in kWh/day) versus MSP (in dollars) for doors, R-value (in h-ft^2-°F/Btu) versus MSP (in dollars) for panels, and AWEF2 (in Btu/h) versus MSP (in dollars). The methodology for developing the curves started with determining the energy consumption for baseline equipment and MPCs for this equipment. For the equipment classes that used the design option approach, DOE implemented design options above baseline using the ratio of cost to savings and implemented only one design option at each efficiency level. Design options were implemented until all available technologies were employed (*i.e.,* at a max-tech level). For the equipment classes that used the efficiency level approach, DOE increased the efficiency level using the ratio of cost to savings above baseline until the maximum efficiency level was reached. See chapter 5 of the NOPR TSD for additional detail on the engineering analysis and appendix 5B of the NOPR TSD for complete cost-efficiency results.

In response to the June 2022 Preliminary Analysis, AHRI requested further clarification on the cost-efficiency data in Tables 5A.5.22, 5A.5.25, 5A.5.34, and 5A.5.35, particularly on how the AWEF values were determined and the cost differences between efficiency levels. (AHRI, No. 39 at p. 3). The cost-efficiency curves were determined using the cost and efficiency analyses. These are discussed in detail in chapter 5 of the June 2022 Preliminary Analysis TSD. The cost and efficiency analyses for this NOPR are described in sections IV.C.1 and IV.C.2 of this document, and in more detail in chapter 5 of the accompanying TSD.

D. Markups Analysis

The markups analysis develops appropriate markups (*e.g.,* retailer markups, distributor markups, contractor markups) in the distribution chain and sales taxes to convert the MSP and shipping cost estimates derived in the engineering analysis to consumer prices, which are then used in the LCC and PBP analysis. At each step in the distribution channel, companies mark up the price of the product to cover business costs and profit margin.

Regarding its markup analysis in the June 2022 Preliminary Analysis, DOE received comments from AHRI and Lennox. AHRI responded that single-packaged dedicated systems are sold through the original equipment manufacturer (''OEM'') distribution channel more so than other walk-in refrigeration systems, where 75 percent of shipments are through OEMs, 15 percent are through refrigeration wholesalers, and the remaining 10 percent are spread across general contractor and equipment distributor. (AHRI, No. 16 at p. 15) Lennox responded that its analysis of e-commerce channels for dedicated condensing equipment, unit coolers and single-packaged dedicated systems indicates these channels are primarily used to source used refurbished equipment. (Lennox, No. 36 at p. 5) Lennox stated that it believes single-packaged dedicated systems could have quicker adoption via e-commerce because of the nature of the equipment and its simpler application use, and that while e-commerce may be a factor in the future, dedicated condensing unit and unit cooler application require knowledgeable personnel to select and balance the equipment. Lennox further commented that with EPA's plans to reduce hydrofluorocarbon (''HFC'') emissions per the AIM Act, low-GWP refrigerants including A2Ls and CO_2 are expected to come into the market, which will increase the complexity of selecting walk-in refrigeration equipment for customers, affecting the rate of e-commerce adoption. *(Id.)*

In response to AHRI, DOE notes that the distribution channels that were used in its June 2022 Preliminary Analysis are consistent with the values provided by AHRI and DOE has maintained these values in its NOPR analysis. DOE tentatively agrees with Lennox's position that the e-commerce distribution channel is primarily used for refurbished/used equipment and that e-commerce may become a viable means of distribution of dedicated condensing and unit cooler equipment in the future. However, DOE notes that refurbished/used equipment are outside the scope of this rulemaking and are therefore not considered in this analysis and that future distribution through e-commerce is uncertain. Because of these uncertainties, DOE has not included the e-commerce distribution channel in this analysis and has maintained the approach used in the June 2022 Preliminary Analysis. However, DOE may consider including walk-ins e-commerce distribution channels in its analysis in a future rulemaking.

DOE seeks comment on e-commerce distribution channels, including which types of walk-in equipment use this channel and the size of this channel.

DOE developed baseline and incremental markups for each agent in the distribution chain. Baseline markups are applied to the price of equipment with baseline efficiency, while incremental markups are applied to the difference in price between baseline and higher-efficiency models (the incremental cost increase). The incremental markup is typically less than the baseline markup and is designed to maintain similar per-unit operating profit before and after new or amended standards.[41] In the context of this analysis, OEMs are mostly manufacturers of envelope insulation panels who may also sell entire walk-in units. Manufacturers of entire walk-in units assemble a combination of purchased and manufactured components at either the manufacturer's plant or at the customer site. Table IV.21 shows the distribution channels DOE defined for this analysis. Table IV.22 summarizes the baseline markups and incremental markups developed for walk-in equipment. The markups shown in this table reflect national average values for the given markup. In the

[41] Because the projected price of standards-compliant equipment is typically higher than the price of baseline equipment, using the same markup for the incremental cost and the baseline cost would result in higher per-unit operating profit. While such an outcome is possible, DOE maintains that in markets that are reasonably competitive it is unlikely that standards would lead to a sustainable increase in profitability in the long run.

subsequent LCC analysis, regional markup multipliers were developed and were used to capture regional variation in mechanical contractor markups as well as state-to-state differences in sales taxes. Also, in the LCC analysis, the relative shipments to new construction and to the replacement market vary by equipment class resulting in some slight differences between sales-weighted average baseline and average incremental markups by equipment class.

TABLE IV.21—DISTRIBUTION CHANNEL WEIGHTS

Distribution channel	Dedicated condensing units and unit coolers	Display doors	Panels and non-display doors	Single-packaged dedicated systems	Unit coolers for multiplex*
Direct (National Account)	0.03	0.30	0.45		0.45
Contractors	0.03	0.14	0.11	0.5	0.01
Distributors	0.34	0.56	0.44	0.5	0.05
OEM	0.18			0.75	0.05
Wholesale	0.42			0.15	0.45
Grand Total	1.00	1.00	1.00	1.00	1.00

*Unit coolers are sold into applications where they are connected to both dedicated, and multiplex condensing systems. While multiplex condensing systems are not currently with scope unit coolers connected to them are.

TABLE IV.22—DISTRIBUTION CHANNEL SHARES AND MARKUPS

Equipment class code	Equipment family	Baseline markup	Incremental markup
DC.L.O	DC	2.03	1.37
DC.L.I	DC	2.03	1.37
DC.M.O	DC	2.03	1.37
DC.M.I	DC	2.03	1.37
UC.L	UC	2.03	1.37
UC.M	UC	2.03	1.37
UC.L—Multiplex	UC	1.98	1.46
UC.M—Multiplex	UC	1.98	1.46
FP.L	P and NDD	1.32	1.19
PS.L	P and NDD	1.32	1.19
PS.M	P and NDD	1.32	1.19
NM.L	P and NDD	1.32	1.19
NM.M	P and NDD	1.32	1.19
NO.L	P and NDD	1.32	1.19
NO.M	P and NDD	1.32	1.19
DW.L	DD	1.71	1.29
DW.M	DD	1.71	1.29
SP.M.I	SP	1.53	1.18
SP.M.O	SP	1.53	1.18
SP.L.I	SP	1.53	1.18
SP.L.O	SP	1.53	1.18
SP.H.I	SP	1.53	1.18
SP.H.O	SP	1.53	1.18
SP.H.ID	SP	1.53	1.18
SP.H.OD	SP	1.53	1.18

Key: DC = dedicated condensing unit; UC = unit cooler; P = panel, NDD = non-display door; DW = display door, SP = single-packaged dedicated system.

After identifying the six distribution channels listed in Table IV.21, DOE relied on economic data from the U.S. Census Bureau [42] and other sources [43] to determine how prices are marked up as equipment is passed from the manufacturer to the customer.

Chapter 6 of the NOPR TSD provides details on DOE's development of markups for walk-in coolers and freezers.

E. Energy Use Analysis

The purpose of the energy use analysis is to determine the annual energy consumption of walk-in coolers and freezers at different efficiencies in representative U.S. commercial buildings, and to assess the energy savings potential of increased walk-in efficiency. The energy use analysis estimates the range of energy use for walk-ins in the field (*i.e.,* as they are actually used by consumers) stated as annual energy consumption (''AEC''). The energy use analysis provides the basis for other analyses DOE performed, particularly assessments of the energy savings and the savings in consumer operating costs that could result from adoption of amended or new standards.

1. Trial Standard Levels

DOE analyzed the benefits and burdens of three trial standard levels (''TSLs'') for the considered walk-in doors, panels, and refrigeration systems. These TSLs were developed by combining specific efficiency levels for each of the equipment classes analyzed by DOE in the engineering analysis, as

[42] U.S. Census Bureau. Electrical, Hardware, Plumbing, and Heating Equipment and Supplies: 2020. 2020. Washington, DC Report No. EC–02–421–17

[43] Heating, Air conditioning & Refrigeration Distributors International. *2012 Profit Report (2011 Data).* 2012. Columbus, OH.

discussed in section IV.A.1 of this document. DOE presents the results for the TSLs in this document by equipment type rather than by equipment class for brevity, while the results for all efficiency levels for each representative unit and equipment class that DOE analyzed are available in chapters 5, 8, and 10 of the NOPR TSD.

To estimate the impacts of improved efficiency on walk-in envelope components (*e.g.,* panels, doors), DOE must first establish the efficiencies and energy use of the connected refrigeration equipment; therefore, DOE is presenting the TSLs in this section of the document. By determining the TSL in the energy use analysis, DOE can estimate the impacts of specific, consistent policy scenarios across both walk-in refrigeration systems and envelope components. For this analysis DOE is examining three TSLs.

TSL 3 is the efficiency levels that use the combination of design options for each representative unit at the maximum feasible technologically level.

TABLE IV.23—ENVELOPE COMPONENTS EFFICIENCY LEVEL BY REPRESENTATIVE UNIT MAPPING FOR TSL 3

Equipment class	TSL 3
Display Doors	
DW.L	2
DW.M	2
Non-display Doors	
NM.L	5
NM.M	6
NO.L	5
NO.M	6
Panels	
PF.L	3
PS.L	2
PS.M	3

TABLE IV.24—REFRIGERATION SYSTEMS EFFICIENCY LEVEL BY REPRESENTATIVE UNIT MAPPING FOR TSL 3

Equipment class	Capacity (kBtu/hr)								
	2	3	6	7	9	25	54	75	124
Dedicated Condensing Systems									
DC.L.I		2			1	3	2		
DC.L.O		3			5	8	5	5	
DC.M.I					1	2	3	3	
DC.M.O					7	8	7	8	8
Single-packaged Dedicated Condensing Systems									
SP.H.I	2			2					
SP.H.ID	2			2					
SP.H.O	6			6					
SP.H.OD	6			6					
SP.L.I	7		3						
SP.L.O	4		4						
SP.M.I	5				3				
SP.M.O	9				5				
Unit Coolers									
UC.H					1	1			
UC.H.ID					1	1			
UC.L.		2			2	2	2	2	
UC.M		2			2	2	2	2	

TSL 2 is the combination of efficiency levels of all representative units where FFC is maximized while constrained to a positive NPV at a 7-percent discount rate. For display doors (DW.L and DW.M) and for panels (PF.L, PS.L, and PS.M) there are no efficiency improvements that results in consumer benefits; therefore, the mapped ELs for this TSL remain at baseline (EL 0). In this proposed rule, the efficiency levels for non-display doors and structural panels at TSL 2 are constrained such that improvements to insulation are harmonized across non-display doors and structural panels to avoid a circumstance where DOE would propose a standard where one component would require increased insulation thickness, but not the other. Thus, the efficiency levels at TSL 2 are aligned to reflect design options where the insulation thickness is harmonized and results in positive NPV for both non-display doors and structural panels. Aligning the insulation thickness of non-display doors and panels avoids a potential unintended consequence where the installation of replacement non-display doors could trigger the replacement of some, or all, of the attached walk-in enclosure panels because the thickness of the components do not match.

DOE seeks comment on its assumptions and rationale for harmonizing panel and non-display door thicknesses at a given TSL.

DOE notes that for refrigeration systems there are no such constraints and TSL 2 is evaluated by the strict criteria of maximum FFC with positive consumer NPV at a 7 percent discount rate. This results in a situation where the combination of ELs for TSL 2 for some equipment are at max-tech levels where others are not.

TABLE IV.25—ENVELOPE COMPONENTS EFFICIENCY LEVEL BY REPRESENTATIVE UNIT MAPPING FOR TSL 2

Equipment class	TSL 2
Display Doors	
DW.L	0
DW.M	0
Non-display Doors	
NM.L	3
NM.M	3

TABLE IV.25—ENVELOPE COMPONENTS EFFICIENCY LEVEL BY REPRESENTATIVE UNIT MAPPING FOR TSL 2—Continued

Equipment class	TSL 2
NO.L	3
NO.M	3
Panels	
PF.L	0
PS.L	0
PS.M	0

TABLE IV.26—REFRIGERATION SYSTEMS EFFICIENCY LEVEL BY REPRESENTATIVE UNIT MAPPING FOR TSL 2

Equipment class	Capacity (kBtu/hr)								
	2	3	6	7	9	25	54	75	124
Dedicated Condensing Systems									
DC.L.I		1			0	2	1		
DC.L.O		2			3	7	4	3	
DC.M.I					0	1	2	2	
DC.M.O					2	3	3	3	3
Single-packaged Dedicated Condensing Systems									
SP.H.I	1			2					
SP.H.ID	2			2					
SP.H.O	5			5					
SP.H.OD	5			6					
SP.L.I	4		2						
SP.L.O	0		0						
SP.M.I	3				1				
SP.M.O	7				3				
Unit Coolers									
UC.H.I					0	0			
UC.H.ID					1	1			
UC.L		2			2	2	2	2	
UC.M		2			2	2	2	2	

TSL 1 is the combination of efficiency levels where NPV at a 7-percent discount rate is maximized. Panels and non-display doors are subject to the same constraint as in TSL 2 that the design options for insulation thickness must result in positive NPV.

TABLE IV.27—ENVELOPE COMPONENTS EFFICIENCY LEVEL BY REPRESENTATIVE UNIT MAPPING FOR TSL 1

Equipment class	TSL 1
Display Doors	
DW.L	0
DW.M	0
Non-display Doors	
NM.L	3
NM.M	1
NO.L	3
NO.M	1
Panels	
PF.L	0
PS.L	0
PS.M	0

TABLE IV.28—REFRIGERATION SYSTEMS EFFICIENCY LEVEL BY REPRESENTATIVE UNIT MAPPING FOR TSL 1

Equipment class	Capacity (kBtu/hr)								
	2	3	6	7	9	25	54	75	124
Dedicated Condensing Systems									
DC.L.I		1			0	2	1		
DC.L.O		2			3	5	3	3	
DC.M.I					0	1	2	2	
DC.M.O					1	2	3	3	2
Single-packaged Dedicated Condensing Systems									
SP.H.I	1			2					
SP.H.ID	2			2					
SP.H.O	4			3					

TABLE IV.28—REFRIGERATION SYSTEMS EFFICIENCY LEVEL BY REPRESENTATIVE UNIT MAPPING FOR TSL 1—Continued

Equipment class	Capacity (kBtu/hr)								
	2	3	6	7	9	25	54	75	124
SP.H.OD	4			3					
SP.L.I	4		2						
SP.L.O	0		0						
SP.M.I	2				1				
SP.M.O	5				3				
Unit Coolers									
UC.H.I					0	0			
UC.H.ID					1	1			
UC.L		1			2	1	2	1	
UC.M		2			1	2	1	2	

2. Energy Use of Envelope Components

DOE used the results of the engineering analysis to determine the annual electrical energy consumption of each walk-in envelope component (*i.e.,* panels, non-display doors, and display doors). For panels, the AEC is calculated as the energy consumption per unit area of the panel for heat infiltration through the panel or door. For doors that use electricity directly from electricity-consuming components (*i.e.,* lighting and/or anti-sweat heaters), DOE calculated the associated increased refrigeration load from the electricity-consuming components and added it to the total to obtain the daily refrigeration load. This refrigeration load was divided by the annual energy efficiency ratio (''AEER'') of the shipment-weighted average of refrigeration system equipment classes grouped by temperature rating to estimate the associated energy use. DOE multiplied the daily electrical energy consumption by the number of days per year to obtain the AEC. DOE then determined the total electrical energy consumption associated with each envelope component by (1) calculating the refrigeration energy consumption required to compensate for heat infiltration through the envelope based on the assumed connected refrigeration system, and (2) adding any direct electrical energy consumed by component. The refrigeration load was calculated by multiplying the U-factor for the component by the reference temperature difference between the exterior and the interior, as specified in the DOE test procedure.

DOE notes that the energy savings from improved insulation or reduced heat infiltration would be realized as reduced load on the attached refrigeration systems; however, for the purpose of reporting savings to determine any potential amended standard, these energy savings are attributed to the individual envelope component in question.

DOE did not receive any comments regarding its energy use analysis pertaining to envelope components and has therefore maintained its approach from the June 2022 Preliminary Analysis.

TABLE IV.29—APPLIED AEERS BY EQUIPMENT CLASS

Equipment class	Baseline	Trial standard level		
		1	2	3
DC.L.I	2.79	2.84	2.84	2.84
DC.L.O	4.10	4.16	4.18	4.82
DC.M.I	5.81	6.09	6.09	6.09
DC.M.O	8.02	8.74	8.74	10.81
SP.L.I	2.11	2.38	2.38	2.47
SP.L.O	3.30	3.30	3.30	3.98
SP.M.I	5.68	6.02	6.05	6.12
SP.M.O	7.80	8.23	8.25	9.65

3. Energy Use of Refrigeration Systems

DOE calculated the AEC of the refrigeration system assuming it is matched to a walk-in envelope with the appropriate refrigeration load. Further, DOE assumes that this refrigeration load is fixed in both the no-new standards and amended standards cases.

The engineering analysis uses a design-option approach that, for each design-option combination, adds a feature that increases efficiency. Hence, equipment class can be represented by a group of efficiency level indicators matching the engineering design option.

For each equipment class, the engineering analysis evaluates the performance of the dedicated condensing unit, unit cooler, or single-packaged dedicated system, and for each representative capacity the performance data are passed to the energy use calculation. The data and equations used to calculate the annual energy use depend on the type of equipment and are available in chapters 7, 8, and associated appendixes of the NOPR TSD. The unit coolers that are not attached to dedicated condensing units are assumed to be paired with a compressor rack with constant net capacity; these are referred to as multiplex applications. Low-temperature unit coolers include the impact of energy consumption during the defrost cycle. For refrigeration systems, the net capacity is affected by the design options added, so at each efficiency level the run hours are adjusted to ensure that the amount of heat removed is constant across all efficiency levels. For outdoor systems, the compressor and condenser performance are also affected by ambient temperature, and this effect is incorporated into the energy use calculation. Detailed equations and input data are presented for each equipment type in chapter 7 of the NOPR TSD.

a. Fan Power

In response to the June 2022 Preliminary Analysis, AHRI commented that refrigeration system fans would need to continuously operate when using A2L refrigerants to reduce the concentration of flammable refrigerants, which might result in the need for evaporator redesign. (AHRI, No. 39 at p. 5) DOE is not aware of a safety standard that requires continuous fan operation for systems using flammable refrigerants. As such, in this NOPR, DOE assumed the same fan operation for refrigeration systems using R–448A or R–449A and refrigeration systems using A2L refrigerants.

b. Nominal Daily Run Hours

The daily run hours for baseline units are assumed to be 16 hours for medium- and high-temperature systems and 18 hours for low-temperature systems based on guidelines typically used in sizing refrigeration systems. DOE assumed that systems were sized at design temperatures of 95 °F for outdoor units and 90 °F for indoor units. DOE also assumed an oversize factor of 20 percent is included, which has the effect of reducing the daily run hours by a factor of $1/1.2$. These assumptions are unchanged from the June 2014 Final Rule and the July 2017 Final Rule. 79 FR 32083, 82 FR 31842. During the rest of the time, the system is in off-mode, so the only energy consumption is from the controls and evaporator fan.

In section ES.4.13 of the Executive Summary of the June 2022 Preliminary Analysis TSD, DOE requested comment on its approach for determining the energy use of walk-in refrigeration systems. DOE received comments from several stakeholder regarding daily run hours.

Lennox stated that DOE's application of 16 hours per day run time is significantly low. (Lennox No. 36 at p. 6) Lennox also stated that WICF refrigeration systems must be properly sized with extended run times to ensure consistent temperature control to preserve the products within. Lennox additionally commented that Heatcraft engineering manual guidelines exist for a range of applications and that Heatcraft guidelines for high-temperature rooms and unit coolers are based on prep room applications where there is a higher level of outside air-infiltration that increases the box loads. Lennox stated that Heatcraft Run Time Guidelines are as follows:

- 35 °F room with no timer: 16 hours,
- 35 °F room with timer: 18 hours,
- Blast coolers/freezers with positive defrost: 18 hours,
- Storage freezer 20 hours,
- 25 to 34 °F coolers with hot gas or electric defrost 20–22 hours, and
- 50 °F rooms and higher with coil temperatures above 32 °F: 20–22 hours.

(Id.)

Additionally, AHRI commented that some of its members stated that some high-temperature unit coolers and high-temperature single-packaged equipment would estimate the run time closer to 20 hours and requested clarification on how the 16-hour per day nominal run time was determined. (AHRI No. 39 at p. 4), Hussmann-Refrigeration agreed with AHRI and stated that 20 hours is the appropriate nominal run time hours for high-temperature single-packaged equipment. (Hussmann-Refrigeration, No. 38 at p. 4)

In response to Lennox, DOE notes that the run time guidelines they provided are specifically for determining the box cooling load for prep-room applications. DOE further notes that these guidelines encompass equipment not currently covered by the standard. In the June 2022 Preliminary Analysis, DOE adopted the run time hours from previous analyses and stakeholder negotiations, in which they have been a central non-contentious modeling assumption. 79 FR 32083, 81 FR 63008, 82 FR 31846. The benefit of using these single point values is that they simplify an already complicated analysis. DOE notes that using a single point assumption for all equipment types may not capture the wide range of ways walk-ins are used in the field. DOE has the technical capability to include a distribution of run time values weighted by different walk-in applications; however, DOE does not have either data or information with enough detail from which to construct such a distribution.

In response to AHRI and Hussmann-Refrigeration and their request for background on why DOE applied 16 hours as the nominal run time hours for high-temperature single-packaged condensing systems and unit coolers, DOE presented this number in the June 2022 Preliminary Analysis as a modeling assumption because the intended cooling temperature of high-temperature equipment is similar to that of medium-temperature systems at 35 °F.

Additionally, AHRI commented that it agreed with the 16-hour per day run time for single-packaged equipment. (AHRI, No. 39 at p. 4) HTPG agreed with the daily nominal run time hours per day for low and medium-temperature single-packaged equipment. (HTPG, No. 35 at p. 6) NAFEM also confirmed that the run times used in the previous rulemaking are still representative. (NAFEM, No. 13 at p. 2)

For this NOPR, DOE is maintaining its modeling assumption of 16 hours per day of nominal daily run hours for high-temperature equipment and maintaining its modeling assumptions from the June 2022 Preliminary Analysis for all other classes. However, in its subgroup analysis, DOE will examine high-temperature equipment where the nominal run time is 20 hours per day to approximate consumers with walk-ins with high warm air-infiltration (*e.g.,* prep-rooms) as a separate consumer subgroup analysis. *See* section IV.I. DOE's applied run time hours are shown in Table IV.30.

TABLE IV.30—APPLIED NOMINAL DAILY RUN HOURS

Temperature	Hrs/day
Low	18
High	16
Medium	16

DOE seeks information and data from which to create representative distributions of run time hours for different walk-in refrigeration equipment and temperature classes.

4. Estimated Annual Energy Consumption

TABLE IV.31—ANNUAL ENERGY CONSUMPTION ESTIMATES FOR PANELS

[kWh/year per ft²]

Equipment class	Baseline	TSL 1	TSL 2	TSL 3
PF.L	5.8	5.8	5.7	4.0
PS.L	9.5	9.4	9.4	5.2
PS.M	2.3	2.2	2.2	1.1

TABLE IV.32—ANNUAL ENERGY CONSUMPTION ESTIMATES FOR DOORS

[kWh/year]

Equipment class	Baseline	TSL 1	TSL 2	TSL 3
DW.L	2,698	2,668	2,663	2,120
DW.M	775	765	762	523
NM.L	3,796	1,318	1,316	1,118
NM.M	1,239	554	281	212
NO.L	5,320	2,049	2,045	1,678
NO.M	1,738	835	462	339

TABLE IV.33—ANNUAL ENERGY CONSUMPTION ESTIMATES FOR REFRIGERATION SYSTEMS

[kWh/year]

Equipment class	Baseline	TSL 1	TSL 2	TSL 3
DC.L.I	26,420	25,917	25,917	25,887
DC.L.O	40,791	40,254	40,090	34,729
DC.M.I	12,178	11,621	11,621	11,615
DC.M.O	17,720	17,478	17,303	13,147
SP.H.I	2,275	2,035	2,035	1,999
SP.H.ID	3,897	3,258	3,258	3,258
SP.H.O	3,184	2,935	2,795	2,746
SP.H.OD	5,264	4,607	4,139	4,127
SP.L.I	6,624	5,880	5,880	5,653
SP.L.O	8,535	8,535	8,535	7,077
SP.M.I	6,360	6,006	5,983	5,907
SP.M.O	5,963	5,645	5,636	4,816
UC.H	4,666	4,666	4,666	4,613
UC.H.ID	6,948	6,519	6,519	6,519
UC.L	45,993	43,845	43,190	43,190
UC.M	17,333	16,895	16,785	16,785

Chapter 7 of the NOPR TSD provides further details on DOE's energy use analysis for walk-ins.

F. Life-Cycle Cost and Payback Period Analysis

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

• The LCC is the total consumer expense of an appliance or product over the life of that product, consisting of total installed cost (manufacturer selling price, distribution chain markups, sales tax, and installation costs) plus operating costs (expenses for energy use, maintenance, and repair). To compute the operating costs, DOE discounts future operating costs to the time of purchase and sums them over the lifetime of the product.

• The PBP is the estimated amount of time (in years) it takes consumers to recover the increased purchase cost (including installation) of a more-efficient product through lower operating costs. DOE calculates the PBP by dividing the change in purchase cost at higher efficiency levels by the change in annual operating cost for the year that amended or new standards are assumed to take effect.

For any given efficiency level, DOE measures the change in LCC relative to the LCC in the no-new-standards case, which reflects the estimated efficiency distribution of walk-ins in the absence of new or amended energy conservation standards. In contrast, the PBP for a given efficiency level is measured relative to the baseline product.

For each considered efficiency level in each equipment class, DOE calculated the LCC and PBP for a nationally representative set of commercial consumers. As stated previously, DOE developed household samples from the 2018 Commercial Buildings Energy Consumption Survey (''CBECS 2018'').[44] For each sample, DOE determined the energy consumption for the walk-ins and the appropriate energy price. By developing a representative sample of commercial consumers, the analysis captured the variability in energy consumption and energy prices associated with the use of walk-ins.

[44] U.S. Energy Information Administration. *Commercial Buildings Energy Consumption Survey 2018,* 2022.

Inputs to the calculation of total installed cost include the cost of the product—which includes MPCs, manufacturer markups, retailer and distributor markups, and sales taxes—and installation costs. Inputs to the calculation of operating expenses include annual energy consumption, energy prices and price projections, repair and maintenance costs, product lifetimes, and discount rates. DOE created distributions of values for product lifetime, discount rates, and sales taxes, with probabilities attached to each value, to account for their uncertainty and variability.

The computer model DOE uses to calculate the LCC relies on a Monte Carlo simulation to incorporate uncertainty and variability into the analysis. The Monte Carlo simulations randomly sample input values from the probability distributions and walk-ins user samples. The model calculated the LCC for products at each efficiency level per simulation run. The analytical results include a distribution of 30,000 data points for refrigeration systems and 10,000 data points for envelope components, showing the range of LCC savings for a given efficiency level relative to the no-new-standards case efficiency distribution. In performing an iteration of the Monte Carlo simulation for a given consumer, product efficiency is chosen based on its probability. If the chosen product efficiency is greater than or equal to the efficiency of the standard level under consideration, the LCC calculation reveals that a consumer is not impacted by the standard level. By accounting for consumers who already purchase more-efficient products, DOE avoids overstating the potential benefits from increasing product efficiency.

DOE calculated the LCC and PBP for consumers of walk-ins as if each were to purchase a new product in the expected year of required compliance with new or amended standards. Amended standards would apply to walk-ins manufactured three years after the date on which any new or amended standard is published. (42 U.S.C. 6313(f)(5)(B)(i)) At this time, DOE estimates publication of a final rule in 2024; therefore, for purposes of its analysis, DOE used 2027 as the first year of compliance with any amended standards for walk-ins.

Table IV.34 summarizes the approach and data DOE used to derive inputs to the LCC and PBP calculations. The subsections that follow provide further discussion. Details of the spreadsheet model, and of all the inputs to the LCC and PBP analyses, are contained in chapter 8 of the NOPR TSD and its appendices.

TABLE IV.34—SUMMARY OF INPUTS AND METHODS FOR THE LCC AND PBP ANALYSIS *

Inputs	Source/method
Product Cost	Derived by multiplying MPCs by manufacturer and retailer markups and sales tax, as appropriate. Used historical data to derive a price scaling index to project product costs.
Installation Costs	Baseline installation cost determined with data from RS Means. Assumed no change with efficiency level.
Annual Energy Use	The total annual energy use multiplied by the buildings containing WICF. *Variability:* Based on the CBECS 2018.
Energy Prices	*Electricity:* Based on EIA's Form 861 data for 2021. *Variability:* Regional energy prices determined for 9 divisions.
Energy Price Trends	Based on *AEO2023* price projections.
Repair and Maintenance Costs	Assumed no change with efficiency level.
Product Lifetime	*Average:* between 9 and 12 years.
Discount Rates	Approach involves identifying all possible debt or asset classes that might be used to purchase the considered appliances, or might be affected indirectly. Primary data source was the Federal Reserve Board's Survey of Consumer Finances.
Compliance Date	2027.

* Not used for PBP calculation. References for the data sources mentioned in this table are provided in the sections following the table or in chapter 8 of the NOPR TSD.

1. Equipment Cost

To calculate consumer product costs, DOE multiplied the MSPs developed in the engineering analysis by the markups described previously (along with sales taxes). DOE used different markups for baseline products and higher-efficiency equipment because DOE applies an incremental markup to the increase in MSP associated with higher-efficiency products.

DOE examined historical producer price index (''PPI'') data for commercial refrigerators and related equipment manufacturing available between 1978 and 2021 from the BLS.[45] Even though this PPI series may also contain prices of refrigeration equipment other than walk-ins, this is the most disaggregated price series that are representative of walk-ins. DOE assumes that this PPI is a close proxy to historical price trends for walk-ins. The PPI data reflect nominal prices, adjusted for product quality changes. The inflation-adjusted (deflated) price index for commercial refrigerators and related equipment manufacturing was calculated by dividing the PPI series by the Gross Domestic Product Chained Price Index.

DOE has observed a spike in the trend of annual real prices between 2021 and 2022. However, when the PPI is examined at a month-by-month level, the nominal PPI from 2022 through 2023 appears to be leveling off. Specifically, the monthly PPI data in Table IV.35 shows the Observation Value increasing from a value of 339 in January 2022 to a value of 375 through July 2022; thereafter the Observed Value increases *slightly* to 378 in February 2023 (emphasis added). As of the publication of this NOPR, the Gross Domestic Product Chained Price Index was not available for 2023; therefore, DOE was unable to include data for the year 2023 in this NOPR. These data will be monitored by DOE. If a trend in the data appears prior to publication of the final rule, DOE will apply it. Additionally, the engineering analysis was conducted in 2022 and captures this increase in terms of walk-in equipment prices. DOE notes that it has captured the impact of this spike, if it were realized, as a constant increase in real prices in the low economic price scenario results shown in section V.C.

TABLE IV.35—EXCERPT FROM PPI INDUSTRY DATA FOR AIR-CONDITIONING, REFRIGERATION, AND FORCED AIR HEATING EQUIPMENT MFG-REFRIGERATION CONDENSING UNITS, ALL REFRIGERANTS, EXCEPT AMMONIA (COMPLETE), NOT SEASONALLY ADJUSTED

[ID PCU3334153334155]

Year	Period	Label	Observation value
2022	M01	2022 Jan	339
2022	M02	2022 Feb	339
2022	M03	2022 Mar	348

[45] Product series ID: PCU3334153334153. Available at: *www.bls.gov/ppi/.*

TABLE IV.35—EXCERPT FROM PPI INDUSTRY DATA FOR AIR-CONDITIONING, REFRIGERATION, AND FORCED AIR HEATING EQUIPMENT MFG-REFRIGERATION CONDENSING UNITS, ALL REFRIGERANTS, EXCEPT AMMONIA (COMPLETE), NOT SEASONALLY ADJUSTED—Continued

[ID PCU3334153334155]

Year	Period	Label	Observation value
2022	M04	2022 Apr	356
2022	M05	2022 May	356
2022	M06	2022 Jun	366
2022	M07	2022 Jul	*375*
2022	M08	2022 Aug	*375*
2022	M09	2022 Sep	*376*
2022	M10	2022 Oct	*375*
2022	M11	2022 Nov	*376*
2022	M12	2022 Dec	*376*
2023	M01	2023 Jan	*377*
2023	M02	2023 Feb	*378*

DOE received no comments on its future price trend methodology in the June 2022 Preliminary Analysis. For this analysis, DOE maintained the same approach for determining future equipment prices as in the June 2022 Preliminary Analysis and assumed that equipment prices would be constant over time in terms of real dollars, *i.e.,* constant 2022 prices.

2. Consumer Sample

DOE conducts its analysis in support of a potential new minimum efficiency standard at the National level. This means that DOE must distribute its sample of consumers of walk-in equipment throughout the Nation to capture variability of key inputs of walk-ins operation. Specifically, for the annual energy use estimate, DOE is concerned about distributing the population of walk-in installations across different regions to capture variability in equipment installation saturations and electricity prices, which will impact the operating cost of the equipment. This distribution of installations is referred to as the ''consumer sample.'' For this analysis DOE used data supplied by AHRI and CBECS to estimate the number of walk-in installations by sector and Census Division. The weights of each representative unit by sector are shown in Table IV.36 through Table IV.38.[46] These weights show that dedicated condensing systems are evenly spread across all sectors, with small business sectors limited to smaller capacity equipment, additionally, single-packaged dedicated condensing systems are limited to the small business sectors and concentrated in the food service sector.

In response to the June 2022 Preliminary Analysis, Lennox requested more detail on the ''Large Other'' sector distribution versus other sectors, especially when compared to the food service sector, which has a much lower sector distribution in the TSD.

The *other* categories, both small and large, are used by CBECS as a catchall for buildings with primary building activities that are not defined within specific categories. In this analysis, DOE defines a small business as one of less than 3000 ft^2 of floorspace, and a large business as one greater than 3000 ft^2 floorspace. When examining CBECS for buildings containing walk-in coolers and freezers (*RFGWIN6*), DOE found the count of walk-in installations in the *other* category to be substantial, leading DOE to conclude that these are installed in grocery sections of ''big box'' retail properties, which do not have a category in CBECS.

HTPG disagreed with DOE's selection of unit capacity values for the respective equipment classes in Table 8.2.1 and Table 8.2.2 of the June 2022 Preliminary Analysis TSD, stating that the range of values is too narrow and does not provide a valid representation of the distribution of WICF into the various sectors. (HTPG, No. 35 at p. 7) HTPG also disagreed with DOE's weighting values reflected in the table for large and small food sales, food service and other sectors for the range of unit capacities selected, commenting that the smaller capacity units would dominate the small sectors with a very low weighting in the large sectors; however, HTPG stated that DOE's data reflects just the opposite distribution. HTPG commented that properly understanding the distribution requires viewing the entire product line with a set of broader capacity ranges in the various sectors. *(Id.)*

As discussed above, and shown in Table IV.36 through Table IV.38, DOE has estimated the installation of walk-in coolers and freezers across several business categories and sizes, and has tried to concentrate the installation of smaller capacity walk-ins into small-sized business. The large weight of walk-ins attributed to *large other* is a result of the large quantity of walk-in installations found in CBECS. Further, for this NOPR, DOE has increased the number of representative capacities within each equipment class to better reflect the size of the equipment distributed in commerce. See section IV.C.1 for a more detailed discussion regarding the selection of analyzed equipment.

Lennox commented that in section 8.2.1.1, bullet 2a of the June 2022 Preliminary Analysis TSD, DOE explains how the proportion of walk-in boxes across medium- and low-temperature applications was determined. Lennox commented that, based on stakeholder input, DOE assumed that the relative proportion of coolers to freezers is ⅔ to ⅓. (Lennox, No. 36 at pp. 6–7) Lennox further commented, however, that DOE displays two equations in that section to conclude its number of coolers and freezes by building type using the same ratio ''⅔,'' instead of ''⅔'' on one and ''⅓'' on the other, which can be assumed to be the split to achieve 100 percent; Lennox stated that this looks like a clerical oversight, which DOE should address. *(Id.)* Further, the CA IOUs noted that most indoor walk-in dedicated condensing units are part of single-packaged dedicated systems, and for the low-temperature, indoor category (778), a total of 1,631 indoor models, or 11 percent of the 15,008 dedicated

[46] A full breakdown of the consumer sample showing the distribution of equipment by Census Division can be found in appendix 8E of the Technical Support Document.

condensing system listings, exist in CCMS. The CA IOUs stated that, for comparison, in food service, generally about one third of walk-ins are freezers while two-thirds of walk-ins are coolers. (CA IOUs, No. 17 at p. 8)

To clarify, in the June 2022 Preliminary Analysis, DOE used the ratios of ⅔ medium-temperature and ⅓ low-temperature to split the market of coolers and freezers in its economic analysis. DOE has maintained this ratio in the NOPR analysis.

TABLE IV.36—CONSUMER SAMPLE AND WEIGHTS—DEDICATED CONDENSING UNITS

[%]

Equipment class	Sector		Capacity (kBtu/hr)					
	Cat.	Size	3	9	25	54	75	124
DC.L.I	Other	Large	23	18	4	10		
		Small	1	1	0	0		
	Sales	Large	4	3	1	2		
		Small	3	3	1	0		
	Service	Large	5	4	1	2		
		Small	7	6	1	0		
DC.L.O	Other	Large	7	25	7	5	14	
		Small	0	2	0	0	0	
	Sales	Large	1	4	1	1	2	
		Small	1	4	1	0	0	
	Service	Large	1	6	1	1	3	
		Small	2	8	2	0	0	
DC.M.I	Other	Large	*12	30	7	4	0	
		Small	*1	2	0	0	0	
	Sales	Large	*2	5	1	1	0	
		Small	*2	4	1	0	0	
	Service	Large	*3	6	1	1	0	
		Small	*4	9	2	0	0	
DC.M.O	Other	Large	*3	30	9	2	6	6
		Small	*0	2	1	0	0	0
	Sales	Large	*1	5	2	0	1	1
		Small	*0	4	1	0	0	0
	Service	Large	*1	7	2	0	1	1
		Small	*1	9	3	0	0	0

*For this NOPR DOE is not considering the impacts of representative units DC.M.I and DC.M.O at the 3 kBtu/hr capacity (*see* the Representative Units subsection of section IV.C.1.d). However, these capacities persist within the consumer sample as they are still distributed in commerce, and the impacts for the fraction of these equipment must be accounted for when determining overall costs and benefits for DC.M.I and DC.M.O as equipment classes even if efficiency improvements are not being considered for these specific capacities.

TABLE IV.37—CONSUMER SAMPLE AND WEIGHTS—SINGLE-PACKAGED DEDICATED SYSTEMS

[%]

Equipment class	Sector		Capacity (kBtu/hr)			
	Cat.	Size	2	6	7	9
SP.H.I	Other	Large	0		0	
		Small	0		0	
	Sales	Large	0		0	
		Small	0		0	
	Service	Large	0		0	
		Small	74		26	
SP.H.ID	Other	Large	0		0	
		Small	0		0	
	Sales	Large	0		0	
		Small	0		0	
	Service	Large	0		0	
		Small	74		26	
SP.H.O	Other	Large	0		0	
		Small	0		0	
	Sales	Large	0		0	
		Small	0		0	
	Service	Large	0		0	
		Small	22		78	
SP.H.OD	Other	Large	0		0	
		Small	0		0	
	Sales	Large	0		0	
		Small	0		0	
	Service	Large	0		0	
		Small	22		78	
SP.L.I	Other	Large	0	0		
		Small	9	4		
	Sales	Large	0	0		
		Small	19	9		
	Service	Large	0	0		
		Small	41	18		
SP.L.O	Other	Large	0	0		
		Small	3	9		
	Sales	Large	0	0		
		Small	7	21		
	Service	Large	0	0		

TABLE IV.37—CONSUMER SAMPLE AND WEIGHTS—SINGLE-PACKAGED DEDICATED SYSTEMS—Continued

[%]

Equipment class	Sector		Capacity (kBtu/hr)			
	Cat.	Size	2	6	7	9
		Small	15	45	....	....
SP.M.I	Other	Large	0	....	....	0
		Small	3	....	....	10
	Sales	Large	0	....	....	0
		Small	6	....	....	22
	Service	Large	0	....	....	0
		Small	14	....	....	46
SP.M.O	Other	Large	0	....	....	0
		Small	1	....	....	12
	Sales	Large	0	....	....	0
		Small	2	....	....	26
	Service	Large	0	....	....	0
		Small	3	....	....	56

TABLE IV.38—CONSUMER SAMPLE AND WEIGHTS—UNIT COOLERS

[%]

Equipment class	Sector		Capacity (kBtu/hr)				
	Cat.	Size	3	9	25	54	75
UC.H.I *	Other	Large	....	0	0	....	....
		Small	....	0	0	....	....
	Sales	Large	....	0	0	....	....
		Small	....	0	0	....	....
	Service	Large	....	30	11	....	....
		Small	....	43	16	....	....
UC.H.ID	Other	Large	....	0	0	....	....
		Small	....	0	0	....	....
	Sales	Large	....	0	0	....	....
		Small	....	0	0	....	....
	Service	Large	....	30	11	....	....
		Small	....	43	16	....	....
UC.L.I	Other	Large	18	16	4	14	0
		Small	1	1	0	1	0
	Sales	Large	3	3	1	3	0
		Small	3	2	1	2	0
	Service	Large	4	3	1	3	0
		Small	6	5	1	5	0
UC.L.M	Other	Large	2	21	28	8	8
		Small	0	0	0	0	0
	Sales	Large	0	4	5	1	1
		Small	0	0	0	1	1
	Service	Large	0	5	6	2	2
		Small	1	0	0	2	2
UC.L.O	Other	Large	6	22	7	7	10
		Small	0	1	0	0	1
	Sales	Large	1	4	1	1	2
		Small	1	3	1	1	2
	Service	Large	1	5	2	2	2
		Small	2	7	2	2	3
UC.M.I	Other	Large	10	27	8	7	0
		Small	1	2	1	0	0
	Sales	Large	2	5	1	1	0
		Small	1	4	1	1	0
	Service	Large	2	6	2	1	0
		Small	3	9	2	2	0
UC.M.M	Other	Large	2	29	19	8	8
		Small	0	0	0	0	0
	Sales	Large	0	5	3	1	1
		Small	0	0	0	1	1
	Service	Large	0	6	4	2	2
		Small	1	0	0	2	2

* For unit coolers, the index I, O, and M indicate that the unit cooler is connected to an Indoor, Outdoor, or Multiplex condensing system.

AHRI commented that it maintains that a small fraction of panels are installed outdoors (AHRI, No. 16 at p. 17) For this analysis, DOE maintained the approach it used in the June 2022 Preliminary Analysis and did not consider panels and doors installed outdoors in this NOPR analysis.

3. Installation Cost

Installation cost includes labor, overhead, and any miscellaneous materials and parts needed to install the product. DOE used data from RSMeans 2023 [47] (''RSMeans'') to estimate the baseline installation cost for walk-in coolers and freezers. The information from RSMeans did not indicate that installation costs would be impacted

[47] Reed Construction Data, *RSMeans Facilities Maintenance & Repair 2013 Cost Data Book,* 2023.

with increased efficiency levels over the baseline for all the designs options considered in the engineering analysis (*see* section IV.C.1). As such, installation costs were not included in the June 2022 Preliminary Analysis.

AHRI, HTPG, Lennox, and Hussmann-Refrigeration disagreed with DOE's assumption that installation costs are not a function of efficiency and stated that characteristics necessary for efficiency gains, like additional sensors, control systems and technologies, will affect installation and manufacturing cost of units. (AHRI, No. 39 at p. 4; HTPG, No. 35 at p. 8; Lennox, No. 36 at p. 8; Hussmann-Refrigeration, No. 38 at p. 5)

DOE tentatively agrees with concerns from AHRI, HTPG, Lennox, and Hussmann-Refrigeration that the inclusion of sensors and controls at increased efficiency levels would increase the cost of equipment installation (and commissioning) over the baseline. Therefore, in the standards case, for this analysis DOE is asserting that the cost of installing will not change with equipment efficiency with the exception of improvements to controls. As this rulemaking covers walk-in equipment where each type of equipment is considered a *package* unto itself, and any control or sensor improvement would be part of said *package;* therefore, there would be no additional costs for control installation, but there would be additional costs for control configuration prior to equipment commissioning. For this analysis, DOE examined RSMeans for the cost of control configuration and added the following installation costs where equipment has the following design option (*see* section IV.C.1 of this document). RSMeans shows that the amount of time to configure most controls is half–hour of labor, while for variable-capacity HVAC drives—used as a proxy for variable-capacity refrigeration compressors—the amount of labor is two hours. DOE assumed the average nonunion shop rate to be $154 (2022$) per hour.[48] In instances where multiple improvements were applied to a single equipment sub-system, (*e.g.,* crank case heating controls: CCHC1 and CCHC2), DOE only included a single control configuration cost. DOE did not find any evidence that control configuration scales with equipment capacity and did not include any additional control configuration costs related to equipment costs.

TABLE IV.39—EXAMPLE INSTALLATION COSTS BY DESIGN OPTION FOR LOW-TEMPERATURE DEDICATED CONDENSING SYSTEMS

Equipment class	kBtu/hr	EL	Design option	Additional installation cost ($)	Total installed cost ($)
DC.L.I	3	0	Baseline	0	0
		1	EC	77	77
		2	CMPVS	308	385
	9	0	Baseline	0	0
		1	CMPVS	308	308
	25	0	Baseline	0	0
		1	CD2	0	0
		2	EC	77	77
		3	CMPVS	308	385
	54	0	Baseline	0	0
		1	CD2	0	0
		2	CMPVS	308	308
DC.L.O	3	0	Baseline	0	0
		1	CCHC1	77	77
		2	CCHC2	0	77
		3	CMPVS	308	385
	9	0	Baseline	0	0
		1	CCHC1	77	77
		2	CCHC2	0	77
		3	VSCF	77	154
		4	ASC	0	154
		5	CMPVS	308	462
	25	0	Baseline	0	0
		1	CCHC1	77	77
		2	CCHC2	0	77
		3	CCF	0	77
		4	EC	77	154
		5	VSCF	0	154
		6	CD2	0	154
		7	ASC	0	154
		8	CMPVS	308	462
	54	0	Baseline	0	0
		1	CCHC1	77	77
		2	CCHC2	0	77
		3	VSCF	77	154
		4	ASC	0	154
		5	CMPVS	308	462
	75	0	Baseline	0	0
		1	CCHC1	77	77
		2	CCHC2	0	77
		3	VSCF	77	154

[48] See: series: 230953103620 and 230953103680.

TABLE IV.39—EXAMPLE INSTALLATION COSTS BY DESIGN OPTION FOR LOW-TEMPERATURE DEDICATED CONDENSING SYSTEMS—Continued

Equipment class	kBtu/hr	EL	Design option	Additional installation cost ($)	Total installed cost ($)
		4	ASC	0	154
		5	CMPVS	308	462

Additionally, HTPG commented that structures may be required to mount products, and increased piping sizes to reduce pressure drop and additional control wiring may be necessary for higher efficiency products, which will increase cost. (HTPG, No. 35 at p. 8) Lennox commented that increase in the product physical size is due to larger heat exchangers and larger equipment could require more costly building structure support as well as increased rigging costs. (Lennox, No. 36 at p. 8)

Neither HTPG nor Lennox provided data or information on the rate at which installation would require new structures or showing that more efficient equipment would require more costly building structures or rigging costs, or any other details to support their claims. In this analysis, DOE is not considering a purchasing shift to larger capacities (*see* section IV.G of this document) but is considering like-for-like capacity installations between the no-new standards and standards cases. As such, DOE did not include any further installation costs for refrigeration systems.

Brooks stated that per 2021ICC (IBC) section 2603.4.1.2 and 2603.4.1.3, cooler and freezer walls—if up to a maximum of 10 inches thick—must have a covering of steel (0.4 mm) or aluminum (0.8mm) and be protected by an automatic sprinkler system.[49] (Brooks, No. 34 at p. 2) Brooks further stated that for installations less than 4 inches thick and WICF less than 400 ft^2 in non-sprinklered buildings, the foam must have a metal facing of aluminum (0.81mm) or non-corrosive steel (0.41mm). (*Id.*)

DOE recognizes the fire code requirements indicated by Brooks and has added $0.50 per ft^2 of installation cost for panels with greater than 4 inches of insulation thickness to cover the cost of facing the panel with non-corrosive steel.

4. Annual Energy Consumption

For each consumer from the consumer sample (*see* section IV.F.2 of this document), DOE determined the energy consumption for walk-ins of the different efficiency levels determined in the engineering analysis (*see* section IV.C.1 of this document) for each TSL (*see* section IV.E.1 of this document) using the approach described previously in section IV.E of this document.

5. Energy Prices

Because marginal electricity price more accurately captures the incremental savings associated with a change in energy use from higher efficiency, it provides a better representation of incremental change in consumer costs than average electricity prices. Therefore, DOE applied average electricity prices for the energy use of the product purchased in the no-new-standards case, and marginal electricity prices for the incremental change in energy use associated with the other efficiency levels considered.

DOE derived electricity prices in 2022 using data from Edison Electric Institute's Typical Bills and Average Rates reports.[50 51] Based upon comprehensive, industry-wide surveys, this semi-annual report presents typical monthly electric bills and average kilowatt-hour costs to the customer as charged by investor-owned utilities. For the commercial sector, DOE calculated electricity prices using the methodology described in Coughlin and Beraki (2019).[52]

For this NOPR DOE maintained the methodology it used in the July 2021 Preliminary Analysis where electricity prices to vary by sector and region. In the analysis, variability in electricity prices is chosen to be consistent with the way the consumer economic and energy use characteristics are defined in the LCC analysis for walk-ins. DOE derived average and marginal annual non-residential (commercial and industrial) electricity prices using data from EIA's Form EIA–861 database (based on ''Annual Electric Power Industry Report''),[53] Edison Electric Institute's Typical Bills and Average Rates Reports, and information from utility tariffs. Electricity tariffs for non-residential consumers can be very complex, with the principal difference from residential rates being the incorporation of demand charges. The presence of demand charges means that two consumers with the same monthly electricity consumption may have very different bills, depending on their peak demand. For this analysis, DOE used marginal electricity prices to estimate the impact of demand charges for consumers of walk-ins and EIA's Annual Energy Outlook 2023 (''AEO2023'') to estimate future energy prices (*see* section IV.F.5.a of this document). DOE developed discount rates from estimates of the finance cost for consumers and commercial businesses that purchase walk-ins. More detail on the methodology of use to calculate the marginal electricity rates can be found in appendix 8B of the NOPR TSD.

[49] International Codes Council, *International Building Codes,* 2018, *codes.iccsafe.org/content/IBC2018P6/chapter-26-plastic#IBC2018P6_Ch26_Sec2603.4.1.2* (Last accessed: March 6, 2023).

[50] Edison Electric Institute, *Typical Bills and Average Rates—Summer 2022,* December 2022, ISBN: 978–1–938066–04–7.

[51] Edison Electric Institute, *Typical Bills and Average Rates—Winter 2022,* June 2022, ISBN: 978–0–931032–88–2.

[52] Coughlin, K. and B. Beraki. 2019. Non-residential Electricity Prices: A Review of Data Sources and Estimation Methods. Lawrence Berkeley National Lab. Berkeley, CA. Report No. LBNL–2001203. *ees.lbl.gov/publications/non-residential-electricity-prices.*

[53] Available at: *www.eia.doe.gov/cneaf/electricity/page/eia861.html.*

TABLE IV.40—MARGINAL AND AVERAGE ELECTRICITY PRICES BY CENSUS DIVISION AND SECTOR SIZE
[2022$/kWh]

Sector	Region	Average electricity	Marginal electricity price
Large Food Sales	1	0.155	0.128
Large Food Service	1	0.155	0.128
Large Other	1	0.155	0.128
Small Food Sales	1	0.175	0.156
Small Food Service	1	0.175	0.156
Small Other	1	0.175	0.156
Large Food Sales	2	0.091	0.072
Large Food Service	2	0.091	0.072
Large Other	2	0.091	0.072
Small Food Sales	2	0.119	0.116
Small Food Service	2	0.119	0.116
Small Other	2	0.119	0.116
Large Food Sales	3	0.104	0.084
Large Food Service	3	0.104	0.084
Large Other	3	0.104	0.084
Small Food Sales	3	0.129	0.116
Small Food Service	3	0.129	0.116
Small Other	3	0.129	0.116
Large Food Sales	4	0.123	0.101
Large Food Service	4	0.123	0.101
Large Other	4	0.123	0.101
Small Food Sales	4	0.151	0.140
Small Food Service	4	0.151	0.140
Small Other	4	0.151	0.140

a. Future Electricity Prices

To estimate energy prices in future years in the June 2022 Preliminary Analysis, DOE multiplied the 2021 energy prices by the projection of annual average price changes for each of the nine census divisions from the Reference case in *AEO 2022,* which has an end year of 2050.[54] To estimate price trends after 2050, DOE assumed constant real prices at the 2050 rate. In section ES.4.17 of the Executive Summary of the June 2022 Preliminary Analysis TSD, DOE requested comment on its assumed average and marginal electricity costs.

AHRI disagreed with the analysis that real electricity price will decrease to 2050 but agrees that average and marginal electricity prices will increase to 2050. (AHRI, No. 39 at p. 4) Hussmann-Refrigeration agrees with the views of the other AHRI members on the matter of electricity costs. (Hussmann-Refrigeration, No. 38 at pp. 4–5)

HTPG agreed with the costs in Table ES.3.18 of the June 2022 Preliminary Analysis TSD. (HTPG, No. 35 at p. 7) HTPG stated that the costs seem in line with the electrical cost of $0.1063/kWh stated in ASHRAE 90.1, but that the trend illustrated in Electricity Price Factor Projections (Figure 8.3.2), with the cost going down year over year, does not seem reasonable. HTPG stated that according to the U.S. Energy Information Administration (EIA), electricity prices have increased 1.8 percent per year in the United States for the past 25 years. HTPG commented that with the phase out of fossil fuels and the process of replacing technologies that use fossil fuels (coal, oil, and natural gas) with technologies that use electricity as a source of energy, the demand for electricity should go up year over year driving prices up even further, not down. *(Id.)*

Lennox stated that DOE's estimate of average and marginal electricity costs up to year 2050 (using as reference the AEO 2022 projection) appears logical. (Lennox, No. 36 at p. 8)

In response to commenters on DOE's future electricity price trend from the June 2022 Preliminary Analysis, DOE notes that it uses the most current price trends developed by EIA for its AEO. For the 2022 publication, future commercial electricity prices were shown to have a slight decrease, in terms of real dollars, over the time period of 2027 through 2050.[55] For this NOPR analysis DOE has applied the most recent AEO (*AEO2023*) which shows a similar, slight downward trend as in the 2022 publication.

6. Maintenance and Repair Costs

Repair costs are associated with repairing or replacing product components that have failed in an appliance; maintenance costs are associated with maintaining the operation of the product. Typically, small incremental increases in product efficiency entail no, or only minor, changes in repair and maintenance costs compared to baseline efficiency products.

AHRI, HTPG, Hussmann-Refrigeration, Lennox, and KeepRite disagreed with DOE's assumption that repair and maintenance costs are not a function of efficiency and stated that the various technologies to make the unit more efficient will affect these costs. (AHRI, No. 39 at p. 4; HTPG, No. 35 at p. 7; Hussmann-Refrigeration, No. 38 at p. 4; KeepRite, No. 41 at p. 3)

For this analysis, DOE has revised its maintenance and repair cost assumptions. DOE notes that the quantity of walk-in refrigeration equipment sold above the current standard is very small. This has resulted in an absence of repair or maintenance data from which DOE can determine an informed methodology. In the absence of such data, DOE has made the simple modeling assumption consumers would pay an additional 10 percent per year of equipment MSP in the standards and no-new-standards cases for each maintenance and repair.

[54] EIA. *Annual Energy Outlook 2022 with Projections to 2050.* Available at *www.eia.gov/forecasts/aeo/* (last accessed February 13, 2023).

[55] EIA. *Annual Energy Outlook 2023.* Available at *www.eia.gov/outlooks/aeo/* (last accessed April 17, 2023).

Lennox stated that hot gas defrost requires additional piping, which will also increase maintenance and repair costs. Lennox stated that it understands DOE has screened out this technology from this analysis but these costs must be considered if hot gas is considered. (Lennox, No. 36 at p. 6) DOE is not considering the cost or benefits of adaptive defrost technologies, such as hot gas defrost, in this analysis.

DOE requests any comment, data, and sources of information for the maintenance and repair costs of walk-in coolers and freezers with the technologies described in IV.C.

7. Equipment Lifetimes

For walk-ins, DOE used lifetime estimates from the June 2022 Preliminary Analysis.

Because the basis for the lifetime estimates in the literature for walk-in equipment is uncertain, DOE used distributions to estimate the lifetimes of walk-in systems and envelope components in the field. The resulting survival function, which DOE assumed has the form of a cumulative Weibull distribution, provides an average and median appliance lifetime. DOE used different Weibull distributions to estimate the lifetimes for similar equipment types. In the July 2021 RFI, DOE presented the following list of the average of the lifetime distributions of WICF equipment used in this analysis, shown in Table IV.41. 86 FR 37687, 37702.

Additionally, DOE maintained its modeling assumption of a minimum service lifetime of 2 years for all equipment classes. This reflects the fact that many units are purchased with a warranty that effectively guarantees that the unit will remain in operation during the warranty period.

Table IV.41 shows the average and maximum lifetimes for walk-in envelope components and refrigeration systems.

TABLE IV.41—LIFETIMES FOR WALK-IN EQUIPMENT

[Years]

Equipment category	WICF equipment lifetimes (years)		
	Panels and display doors	Non-display doors	Refrigeration equipment
Average Lifetime	12	8.5	10.5
Maximum Lifetime	25	12	20

For this analysis, DOE maintained the lifetimes from the June 2022 Preliminary Analysis.

8. Discount Rates

The discount rate is the rate at which future expenditures are discounted to estimate their present value. DOE employs a two-step approach in calculating discount rates for analyzing customer economic impacts (*e.g.,* LCC). The first step is to assume that the actual cost of capital approximates the appropriate customer discount rate. The second step is to use the capital asset pricing model (''CAPM'') to calculate the equity capital component of the customer discount rate. For this NOPR, DOE estimated a statistical distribution of commercial customer discount rates of walk-in consumers, by calculating the cost of capital for the different types of walk-in owners.

DOE's method views the purchase of a higher efficiency appliance as an investment that yields a stream of energy cost savings. DOE derived the discount rates for the LCC analysis by estimating the cost of capital for companies that purchase walk-ins. For private firms, the weighted average cost of capital (''WACC'') is commonly used to estimate the present value of cash flows to be derived from a typical company project or investment. Most companies use both debt and equity capital to fund investments, so their cost of capital is the weighted average of the cost to the firm of equity and debt financing, as estimated from financial data for publicly traded firms in the sectors that purchase distribution transformers.[56] As discount rates can differ across industries, DOE estimates separate discount rate distributions for a number of aggregate sectors with which elements of the LCC building sample can be associated.

DOE received no comments on its discount rate methodology and analysis and maintained its approach for this NOPR. See chapter 8 of the NOPR TSD for further details on the development of consumer discount rates.

9. Energy Efficiency Distribution in the No-New-Standards Case

To estimate the share of consumers that would be affected by a potential energy conservation standard at a particular efficiency level, DOE's LCC analysis considered the projected distribution (market shares) of product efficiencies under the no-new-standards case (*i.e.,* the case without amended or new energy conservation standards).

To estimate the energy efficiency distribution of walk-ins for 2027, DOE used information provided from stakeholder in response to the June 2022 Preliminary Analysis and records from DOE's CCMS database. The estimated market shares for the no-new-standards case for walk-in coolers and freezers panels and doors are shown in Table IV.42. See chapter 8 of the NOPR TSD for further information on the derivation of the efficiency distributions.

Lennox stated that it has yet to observe customer demand for higher efficiency walk-in equipment (dedicated condensing systems, unit coolers, and single-packaged units) versus equipment meeting the base walk-ins standard. While there is potential for higher efficiency product demand, consumers are buying the base walk-in equipment that meets the minimum standard levels. (Lennox, No. 36 at p. 7)

Regarding refrigeration systems, for this analysis, DOE tentatively agrees with the statement from Lennox stating that while more efficient equipment designs are possible to manufacture, there is little market for them. For refrigeration systems, DOE has made the modeling assumption that all walk-in coolers and freezers refrigeration systems would be at baseline in the no-new-standards case. However, for non-display doors and panels, DOE did apply the rates of more efficient designs found in DOE's CCMS database.[57] DOE related the fraction of designs in the

[56] Previously, Damodaran Online provided firm-level data, but now only industry-level data is available, as compiled from individual firm data, for the period of 1998–2018. The data sets note the number of firms included in the industry average for each year.

[57] U. S. Department of Energy. *Compliance Certification Database.* 2023. *https://www.regulations.doe.gov/certification-data/* (Last accessed: February 1, 2023).

CCMS database to the different panel and non-display doors efficiency levels based on the percentage reduction in daily energy consumption (kWh/day). (*see* sections IV.C.1.b and IV.C.1.c of this document).

DOE acknowledges that its application of the equipment information available in CCMS is not consistent over the different equipment types covered in this analysis; however, DOE has found that the resulting distribution of efficiencies for envelope components and refrigeration systems is a close reflection of the overall sales of efficient equipment disclosed to DOE during confidential manufacturer interviews.

TABLE IV.42—DISTRIBUTION OF EFFICIENCIES IN THE NO-NEW STANDARDS CASE FOR PANEL AND NON-DISPLAY DOORS BY EFFICIENCY LEVEL

Efficiency level	Equipment class						
	NM.L	NM.M	NO.L	NO.M	PF.L	PS.L	PS.M
0	0.48	0.20	0.85	0.12	0.34	0.64	0.49
1	0.14	0.18	0.07	0.08	0.48	0.25	0.30
2	0.17	0.53	0.08	0.71	0.13	0.11	0.21
3	0.17	0.09	0.00	0.09	0.06	0.00	0.00
4	0.04	0.00	0.00	0.00			
5	0.00	0.00	0.00	0.00			
6	0.00	0.00	0.00	0.00			

The LCC Monte Carlo simulations draw from the efficiency distributions and randomly assign an efficiency to the walk-in coolers and freezers purchased by each sample consumer in the no-new-standards case. The resulting percent shares within the sample match the market shares in the efficiency distributions.

10. Payback Period Analysis

The payback period (''PBP'') is the amount of time (expressed in years) it takes the consumer to recover the additional installed cost of more-efficient products, compared to baseline products, through energy cost savings. PBPs that exceed the life of the product mean that the increased total installed cost is not recovered in reduced operating expenses.

The inputs to the PBP calculation for each efficiency level are the change in total installed cost of the product and the change in the first-year annual operating expenditures relative to the baseline. DOE refers to this as a ''simple PBP'' because it does not consider changes over time in operating cost savings. The PBP calculation uses the same inputs as the LCC analysis when deriving first-year operating costs.

As noted previously, EPCA establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the consumer will be less than three times the value of the first year's energy savings resulting from the standard, as calculated under the applicable test procedure, when purchasing a product in compliance with an energy conservation standard level. (42 U.S.C. 6295(o)(2)(B)(iii)) For each considered efficiency level, DOE determined the value of the first year's energy savings by calculating the energy savings in accordance with the applicable DOE test procedure and multiplying those savings by the average energy price projection for the year in which compliance with the amended standards would be required.

G. Shipments Analysis

DOE uses projections of annual product shipments to calculate the national impacts of potential amended or new energy conservation standards on energy use, NPV, and future manufacturer cash flows.[58] The shipments model takes an accounting approach, tracking market shares of each equipment class and the vintage of units in the stock. Stock accounting uses product shipments as inputs to estimate the age distribution of in-service product stocks for all years. The age distribution of in-service product stocks is a key input to calculations of both the NES and NPV, because operating costs for any year depend on the age distribution of the stock.

To calculate projected shipments of each equipment type, DOE uses a two-step approach. In the first step, the annual shipments of completed walk-in installations (hereafter referred to as ''boxes'') of all types are calculated using a stock model, whose principal inputs are commercial floor space projections and the average lifetime of a walk-in box. In the second step, the various types of refrigeration systems and envelopes are partitioned over the shipments of the entire market for boxes.

DOE modeled the shipments of walk-in boxes to three commercial building sectors: food sales, food service and other. Projections of the growth in floor space for each of these sectors are taken from the *Annual Energy Outlook 2023* (*AEO2023*)[59] Reference case. To estimate the lifetime of walk-in boxes, DOE used the distribution from the LCC (*see* chapter 8 of the June 2022 Preliminary Analysis TSD).

Shipments of walk-in coolers and freezers are driven by new purchases and stock replacements due to failures. In each year, the model calculates total stock by vintage and then estimates the number of units that will fail. The number of units that fail determines the replacement shipments in that year. Shipments to new installations are determined by the market saturation (number of boxes per square foot) multiplied by the new floor space constructed in that year. As walk-in boxes have been in use for several decades, DOE assumed that market saturations are constant.

AHRI commented that it has seen a shift in volume estimates towards larger equipment for WICFs but cannot provide justification as to why and need more time to review. (AHRI, No. 39 at p. 4) Hussmann-Refrigeration commented that it supports AHRI's comment (Hussmann-Refrigeration, No. 38 at p. 4)

DOE notes that the comments from AHRI and Hussmann-Refrigeration regarding a growth trend in the overall capacity of walk-in refrigeration equipment is of interest and could be incorporated into its shipments and downstream analysis, provided that specific details can be determined. DOE would need to know if this shift in capacity toward larger equipment affects

[58] DOE uses data on manufacturer shipments as a proxy for national sales, as aggregate data on sales are lacking. In general, one would expect a close correspondence between shipments and sales.

[59] U.S. Energy Information Administration. Annual Energy Outlook 2023.

all refrigeration systems (*i.e.,* dedicated condensing systems, unit coolers, or single-packaged condensing systems) and all applications and temperature classes (*i.e.,* indoor/outdoor or low-, medium- or high-temperature equipment). Additionally, DOE would need information as to whether this trend toward higher capacity equipment will come at the expense of small capacity equipment and, if so, which capacities specifically. If DOE were to apply a capacity growth trend to its existing analysis with the information provided by AHRI, without further details, it could result in an overstatement of benefits as larger capacity equipment are showing greater potential benefits.

For this analysis, DOE continued to maintain the constant market shares for refrigeration equipment as presented in the June 2022 Preliminary Analysis.

DOE requests information or data to characterize a shift toward larger capacity equipment in its analysis. DOE seeks information about the represented units, customer types (food service, food sales, other), and business sizes effected.

Additionally, AHRI, Hussmann-Refrigeration, and HTPG commented that DOE's initial shipments estimates were overstated. (Hussmann-Refrigeration, No. 38 at p. 5; HTPG, No. 35 at p. 8; AHRI, No. 39 at p. 5)

AHRI, Hussmann-Refrigeration, and HTPG did not specify which shipment they found to be overstated. However, DOE notes that in the July 2022 public meeting (EERE–2017–BT–STD–0009–0026), it had mislabeled the metric of shipments for refrigeration systems on slide number 35 as the number of physical units shipped, and that in fact it should have been labeled capacity shipped in kBtu/hr; DOE notes this may be the cause of the appearance of inflated shipments. DOE's initial shipment estimates are shown in section IV.G.2 of this document.

1. Price Elasticity

Economic theory suggests that changes in the price of walk-in components resulting from this standard could potentially affect the number of shipments due to the price elasticity of demand. This might take the form of either a decrease in shipments in cases where purchase costs increase or an increase in shipments in cases where life-cycle costs decrease. But this general economic theory applies differently in different contexts and, based on the information available to DOE, indicates that shipments will not be meaningfully affected by the proposed rule.

Lennox commented on DOE's assumption that a decrease in shipments would be unlikely in the walk-in market due to potential new standards. (Lennox, No. 36 at p. 8) Lennox supported DOE's modeling assumption that future shipments would either not be affected, or would only be marginally affected, by new standards as long as the standards were ''reasonable'' and cost-justified by consumers. (*Id.*) However, DOE notes that Lennox did not specifically quantify what a ''reasonable'' and cost-justified level would be. The levels proposed in this analysis show positive economic benefits for consumers (see section V.B.1.a for LCC results) and the Nation as whole.

For this analysis, DOE continues to use the assumption in the June 2022 Preliminary Analysis that a decrease in shipments is unlikely in the walk-in market. In addition, DOE observes that changes in purchasing behavior are unlikely due to the essential nature of the equipment and the lack of available substitutes. Moreover, the substantial savings to consumers over the lifetime of the equipment is expected to positively affect consumer purchasing incentives. Based on these considerations, and the lack of contradictory information, DOE continues to assume that the shipments do not change between the base case and standards case.

2. Shipments Results

TABLE IV.43—PROJECTED SHIPMENTS OF WICF BOXES FOR SELECT YEARS

[2027–2056]

Year	Food sales	Food service	Other	Total
2027	24,488	34,423	91,740	150,652
2031	24,867	35,339	94,367	154,573
2035	25,865	37,502	99,254	162,621
2039	26,528	39,052	103,269	168,850
2043	27,402	41,017	108,051	176,470
2047	28,071	42,559	112,600	183,229
2051	28,749	44,072	116,556	189,378
2056	28,881	44,367	117,358	190,605

H. National Impact Analysis

The NIA assesses the NES and the NPV from a national perspective of total consumer costs and savings that would be expected to result from new or amended standards at specific efficiency levels.[60] (''Consumer'' in this context refers to consumers of the product being regulated.) DOE calculates the NES and NPV for the potential standard levels considered based on projections of annual product shipments, along with the annual energy consumption and total installed cost data from the energy use and LCC analyses. For the present analysis, DOE projected the energy savings, operating cost savings, product costs, and NPV of consumer benefits over the lifetime of walk-ins sold from 2027 through 2056.

DOE evaluates the impacts of new or amended standards by comparing a case without such standards with standards-case projections. The no-new-standards case characterizes energy use and consumer costs for each equipment class in the absence of new or amended energy conservation standards. For this projection, DOE considers historical trends in efficiency and various forces that are likely to affect the mix of efficiencies over time. DOE compares the no-new-standards case with projections characterizing the market for each equipment class if DOE adopted new or amended standards at specific energy efficiency levels (*i.e.,* the TSLs or standards cases) for that class. For the standards cases, DOE considers how a given standard would likely affect the market shares of products with efficiencies greater than the standard.

DOE uses a model to calculate the energy savings and the national consumer costs and savings from each TSL. The NIA spreadsheet model uses typical values (as opposed to probability distributions) as inputs.

[60] The NIA accounts for impacts in the 50 states and U.S. territories.

Table IV.44 summarizes the inputs and methods DOE used for the NIA analysis for the NOPR. Discussion of these inputs and methods follows the table. *See* chapter 10 of the NOPR TSD for further details.

TABLE IV.44—SUMMARY OF INPUTS AND METHODS FOR THE NATIONAL IMPACT ANALYSIS

Inputs	Method
Shipments	Annual shipments from shipments model.
Compliance Date of Standard	2027.
Efficiency Trends	Constant.
Annual Energy Consumption per Unit	Annual weighted-average values are a function of energy use at each TSL.
Total Installed Cost per Unit	Annual weighted-average values are a function of cost at each TSL. Incorporates projection of future product prices based on historical data.
Annual Energy Cost per Unit	Annual weighted-average values as a function of the annual energy consumption per unit and energy prices.
Repair and Maintenance Cost per Unit	Annual values do not change with efficiency level.
Energy Price Trends	*AEO2023* projections (to 2050) and constant thereafter.
Energy Site-to-Primary and FFC Conversion	A time-series conversion factor based on *AEO2023.*
Discount Rate	3 percent and 7 percent.
Present Year	2023.

1. Product Efficiency Trends

A key component of the NIA is the trend in energy efficiency projected for the no-new-standards case and each of the standards cases. Section IV.F.9 of this document describes how DOE developed an energy efficiency distribution for the no-new-standards case (which yields a shipment-weighted average efficiency) for each of the considered equipment classes for the year of anticipated compliance with an amended or new standard. To project the trend in efficiency absent amended standards for walk-in coolers and freezers over the entire shipment's projection period, DOE maintained constant efficiencies.

DOE used the shipments-weighted energy efficiency distribution for 2027 (the assumed date of compliance with a new standard) as a starting point. To represent the distribution of walk-in energy efficiencies in 2027, DOE used the same market shares as used in the no-new-standards case for the life-cycle cost analysis (*see* section IV.C.1.a). The approach is further described in chapter 10 of the NOPR TSD.

For the standards cases, DOE used a ''roll-up'' scenario to establish the shipment-weighted efficiency for the year that standards are assumed to become effective (2027). In this scenario, the market shares of products in the no-new-standards case that do not meet the standard under consideration would ''roll up'' to meet the new standard level, and the market share of products above the standard would remain unchanged.

To develop standards case efficiency trends after 2027, DOE assumed that efficiency would remain constant.

2. National Energy Savings

The NES analysis involves a comparison of national energy consumption of the considered products between each potential standards case (''TSL'') and the case with no new or amended energy conservation standards. DOE calculated the national energy consumption by multiplying the number of units (stock) of each product (by vintage or age) by the unit energy consumption (also by vintage). DOE calculated annual NES based on the difference in national energy consumption for the no-new-standards case and for each higher efficiency standard case. DOE estimated energy consumption and savings based on site energy and converted the electricity consumption and savings to primary energy (*i.e.,* the energy consumed by power plants to generate site electricity) using annual conversion factors derived from *AEO2023.* Cumulative energy savings are the sum of the NES for each year over the timeframe of the analysis.

Use of higher-efficiency products is sometimes associated with a direct rebound effect, which refers to an increase in utilization of the equipment due to the increase in efficiency. DOE did not find any data on the rebound effect specific to walk-ins. Further, due to the nature of the walk-ins used in commercial applications, those using the equipment would not likely have knowledge of the equipment's efficiency and would not likely alter their usage behavior based on the equipment's efficiency. Because of this, DOE has not applied a rebound effect for this analysis.

In a statement of policy published on August 18, 2011 (''August 2011 Statement of Policy''), in response to the recommendations of a committee on ''Point-of-Use and Full-Fuel-Cycle Measurement Approaches to Energy Efficiency Standards'' appointed by the National Academy of Sciences, DOE announced its intention to use FFC measures of energy use and greenhouse gas and other emissions in the national impact analyses and emissions analyses included in future energy conservation standards rulemakings. 76 FR 51281. After evaluating the approaches discussed in the August 2011 Statement of Policy, DOE published a statement of amended policy on August 17, 2012 in which it explained its determination that EIA's National Energy Modeling System (''NEMS'') is the most appropriate tool for its FFC analysis and its intention to use NEMS for that purpose. 77 FR 49701. NEMS is a public domain, multi-sector, partial equilibrium model of the U.S. energy sector [61] that EIA uses to prepare its *Annual Energy Outlook.* The FFC factors incorporate losses in production and delivery in the case of natural gas (including fugitive emissions) and additional energy used to produce and deliver the various fuels used by power plants. The approach used for deriving FFC measures of energy use and emissions is described in appendix 10A of the NOPR TSD.

3. Net Present Value Analysis

The inputs for determining the NPV of the total costs and benefits experienced by consumers are (1) total annual installed cost, (2) total annual operating costs (*i.e.,* energy costs and repair and maintenance costs), and (3) a discount factor to calculate the present value of costs and savings. DOE calculates net savings each year as the difference between the no-new-standards case and each standards case in terms of total savings in operating costs versus total increases in installed

[61] For more information on NEMS, refer to *The National Energy Modeling System: An Overview 2009,* DOE/EIA–0581(2009), October 2009. Available at *www.eia.gov/forecasts/aeo/index.cfm* (last accessed April 17, 2023).

costs. DOE calculates operating cost savings over the lifetime of each product shipped during the projection period.

As discussed in section IV.F.1 of this document, DOE developed walk-in price trends based on historical PPI data. DOE applied the same trends to project prices for each equipment class at each considered TSL. DOE did not receive comments on its future price trend methodology as presented in the June 2022 Preliminary Analysis; as such, DOE maintained constant real prices throughout this analysis. DOE's projection of product prices is described in appendix 10C of the NOPR TSD.

To evaluate the effect of uncertainty regarding the price trend estimates, DOE investigated the impact of different product price projections on the consumer NPV for the considered TSLs for walk-ins in addition to the default price trend. DOE considered two product price sensitivity cases: (1) a high price decline case based on the period between 2005 and 2021 showing a price increase of 1.29 percent a year, and (2) a low price decline case based on the period between 1978 and 2004 showing a price decline of 0.56 percent per year. The derivation of these price trends and the results of these sensitivity cases are described in appendix 10C of the NOPR TSD.

The energy cost savings are calculated using the estimated energy savings in each year and the projected price of the appropriate form of energy. To estimate energy prices in future years, DOE multiplied the average National energy prices by the projection of annual National-average commercial energy price changes in the Reference case from *AEO2023,* which has an end year of 2050. To estimate price trends after 2050, DOE used constant real prices at 2050 levels. As part of the NIA, DOE also analyzed scenarios that used inputs from variants of the *AEO2023* Reference case that have lower and higher economic growth. Those cases have lower and higher energy price trends compared to the Reference case. NIA results based on these cases are presented in appendix 10C of the NOPR TSD.

In considering the consumer welfare gained due to the direct rebound effect, DOE accounted for change in consumer surplus attributed to additional cooling from the purchase of a more efficient unit. Overall consumer welfare is generally understood to be enhanced from rebound. The net consumer impact of the rebound effect is included in the calculation of operating cost savings in the consumer NPV results. For walk-ins, DOE found no evidence that a rebound effect occurs and did not apply a rebound effect for this analysis.

DOE requests comments on its assumption that there is no rebound effect for walk-in coolers and freezers.

In calculating the NPV, DOE multiplies the net savings in future years by a discount factor to determine their present value. For this NOPR, DOE estimated the NPV of consumer benefits using both a 3-percent and a 7-percent real discount rate. DOE uses these discount rates in accordance with guidance provided by the Office of Management and Budget (''OMB'') to Federal agencies on the development of regulatory analysis.[62] The discount rates for the determination of NPV are in contrast to the discount rates used in the LCC analysis, which are designed to reflect a consumer's perspective. The 7-percent real value is an estimate of the average before-tax rate of return to private capital in the U.S. economy. The 3-percent real value represents the ''social rate of time preference,'' which is the rate at which society discounts future consumption flows to their present value.

I. Consumer Subgroup Analysis

In analyzing the potential impact of new or amended energy conservation standards on consumers, DOE evaluates the impact on identifiable subgroups of consumers that may be disproportionately affected by a new or amended national standard. The purpose of a subgroup analysis is to determine the extent of any such disproportional impacts. DOE evaluates impacts on particular subgroups of consumers by analyzing the LCC impacts and PBP for those particular consumers from alternative standard levels. For this NOPR, DOE analyzed the impacts of the considered standard levels on the following two subgroups:

1. High Warm Air-Infiltration Applications

In response to comments discussed in section IV.E.3.b of this document, DOE is including a subgroup to approximate the impacts for business where walk-ins are operated in environments with higher warm air-infiltration. This would have the effect of putting a greater cooling load on the refrigeration equipment, thus increasing run hours. For this subgroup DOE has assumed 20 daily run hours for all refrigeration system equipment.

The results of this analysis can be found in Table V.51, Table V.52, and Table V.53, which show increased benefits for, in terms of LCC savings, for all equipment. This is a direct result of the increased hours of operation.

2. Small Businesses

This analysis used subsets of the CBECS 2018 sample composed of businesses that are small business in the consumer sample (see section: IV.F.2 of this document). DOE used the LCC and PBP model to estimate the impacts of the considered efficiency levels on these subgroups. DOE used adjusted electricity costs and discount rates to better reflect these costs experienced by small businesses.

TABLE IV.45—ELECTRICITY COSTS FOR SMALL BUSINESSES

[2022$/kWh]

Sector	Region	Average	Marginal
Small Food Sales	1	0.175	0.156
Small Food Service	1	0.175	0.156
Small Other	1	0.175	0.156
Small Food Sales	2	0.119	0.116
Small Food Service	2	0.119	0.116
Small Other	2	0.119	0.116
Small Food Sales	3	0.129	0.116
Small Food Service	3	0.129	0.116
Small Other	3	0.129	0.116
Small Food Sales	4	0.151	0.14

[62] United States Office of Management and Budget. Circular A–4: Regulatory Analysis. September 17, 2003. Section E. Available at *www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/circulars/A4/a-4.pdf.* (last accessed February 9, 2023).

TABLE IV.45—ELECTRICITY COSTS FOR SMALL BUSINESSES—Continued

[2022$/kWh]

Sector	Region	Average	Marginal
Small Food Service	4	0.151	0.14
Small Other	4	0.151	0.14

TABLE IV.46—DISTRIBUTION OF DISCOUNT RATES FOR SMALL BUSINESSES

Sector	Discount rate (%)	Weight
Small Food Sales	0.0649	0.1201
Small Food Sales	0.0743	0.4700
Small Food Sales	0.0838	0.2598
Small Food Sales	0.0933	0.0358
Small Food Sales	0.1067	0.0393
Small Food Sales	0.1176	0.0370
Small Food Sales	0.1205	0.0208
Small Food Sales	0.1425	0.0173
Small Food Service	0.0798	0.0516
Small Food Service	0.0850	0.3690
Small Food Service	0.0944	0.4114
Small Food Service	0.1009	0.0810
Small Food Service	0.1138	0.0440
Small Food Service	0.1215	0.0429
Small Other	0.0433	0.0859
Small Other	0.0567	0.0493
Small Other	0.0637	0.1416
Small Other	0.0714	0.0518
Small Other	0.0854	0.2307
Small Other	0.0945	0.2325
Small Other	0.1048	0.1053
Small Other	0.1154	0.0590
Small Other	0.1237	0.0355
Small Other	0.1311	0.0083

The results of the small businesses subgroup analysis are shows increased consumer benefit across most equipment, as shown in Table V.51, Table V.52, and Table V.53. The increase in benefits is driven by the higher electricity prices attributed to small businesses customers.

Chapter 11 in the NOPR TSD describes the consumer subgroup analysis.

DOE requests comments on its subgroups analysis.

J. Manufacturer Impact Analysis

1. Overview

DOE performed an MIA to estimate the financial impacts of amended energy conservation standards on manufacturers of walk-ins and to estimate the potential impacts of such standards on direct employment and manufacturing capacity. The MIA has both quantitative and qualitative aspects and includes analyses of projected industry cash flows, the INPV, investments in research and development (''R&D'') and manufacturing capital, and domestic manufacturing employment. Additionally, the MIA seeks to determine how amended energy conservation standards might affect manufacturing employment, capacity, and competition, as well as how standards contribute to overall regulatory burden. Finally, the MIA serves to identify any disproportionate impacts on manufacturer subgroups, including small business manufacturers.

The quantitative part of the MIA primarily relies on the Government Regulatory Impact Model (''GRIM''), an industry cash flow model with inputs specific to this rulemaking. The key GRIM inputs include data on the industry cost structure, unit production costs, product shipments, manufacturer markups, and investments in R&D and manufacturing capital required to produce compliant products. The key GRIM outputs are the INPV, which is the sum of industry annual cash flows over the analysis period, discounted using the industry-weighted average cost of capital, and the impact to domestic manufacturing employment. The model uses standard accounting principles to estimate the impacts of more-stringent energy conservation standards on a given industry by comparing changes in INPV and domestic manufacturing employment between a no-new-standards case and the various standards cases. To capture the uncertainty relating to manufacturer pricing strategies following amended standards, the GRIM estimates a range of possible impacts under different manufacturer markup scenarios.

The qualitative part of the MIA addresses manufacturer characteristics and market trends. Specifically, the MIA considers such factors as a potential standard's impact on manufacturing capacity, competition within the industry, the cumulative impact of other DOE and non-DOE regulations, and impacts on manufacturer subgroups. The complete MIA is outlined in chapter 12 of the NOPR TSD.

DOE conducted the MIA for this rulemaking in three phases. In Phase 1 of the MIA, DOE prepared a profile of the walk-in manufacturing industry based on the market and technology assessment, preliminary manufacturer interviews, and publicly-available information. This included a top-down analysis of walk-in door, panel, and refrigeration system manufacturers that DOE used to derive preliminary financial inputs for the GRIM (*e.g.,* revenues; materials, labor, overhead, and depreciation expenses; selling, general, and administrative expenses (''SG&A''); and R&D expenses). DOE also used public sources of information to further calibrate its initial characterization of the walk-in manufacturing industry, including company filings of form 10–K from the SEC,[63] corporate annual reports, the U.S. Census Bureau's *Annual Survey of Manufactures* (*ASM*),[64] and reports from Dun & Bradstreet.[65]

In Phase 2 of the MIA, DOE prepared a framework industry cash flow analysis to quantify the potential impacts of amended energy conservation standards. The GRIM uses several factors to determine a series of annual cash flows starting with the announcement of the standard and extending over a 30-year period following the compliance date of the standard. These factors include annual expected revenues, costs of sales, SG&A and R&D expenses, taxes, and capital expenditures. In general, energy conservation standards can affect manufacturer cash flow in three distinct ways: (1) creating a need for increased investment, (2) raising production costs per unit, and (3) altering revenue due to higher per-unit prices and changes in sales volumes.

In addition, during Phase 2, DOE developed interview guides to distribute to manufacturers of walk-ins in order to develop other key GRIM inputs, including product and capital conversion costs, and to gather additional information on the anticipated effects of energy conservation standards on revenues, direct employment, capital assets, industry competitiveness, and subgroup impacts.

In Phase 3 of the MIA, DOE conducted structured, detailed interviews with representative manufacturers. During these interviews, DOE discussed engineering, manufacturing, procurement, and financial topics to validate assumptions used in the GRIM and to identify key issues or concerns. See section IV.J.3 of this document for a description of the key issues raised by manufacturers during the interviews. As part of Phase 3, DOE also evaluated subgroups of manufacturers that may be disproportionately impacted by amended standards or that may not be accurately represented by the average cost assumptions used to develop the industry cash flow analysis. Such manufacturer subgroups may include small business manufacturers, low-volume manufacturers, niche players, and/or manufacturers exhibiting a cost structure that largely differs from the industry average. DOE identified one subgroup for a separate impact analysis: small business manufacturers. The small business subgroup is discussed in section VI.B of this document, ''Review under the Regulatory Flexibility Act'' and in chapter 12 of the NOPR TSD.

2. Government Regulatory Impact Model and Key Inputs

DOE uses the GRIM to quantify the changes in cash flow due to new or amended standards that result in a higher or lower industry value. The GRIM uses a standard, annual discounted cash flow analysis that incorporates manufacturer costs, markups, shipments, and industry financial information as inputs. The GRIM models changes in costs, distribution of shipments, investments, and manufacturer margins that could result from an amended energy conservation standard. The GRIM spreadsheet uses the inputs to arrive at a series of annual cash flows, beginning in 2023 (the base year of the analysis) and continuing to 2056. DOE calculated INPVs by summing the stream of annual discounted cash flows during this period. For walk-in door, panel, and refrigeration system manufacturers, DOE used a real discount rate of 9.4 percent, 10.5 percent, and 10.2 percent, respectively, which was derived from industry financials and then modified according to feedback received during manufacturer interviews.

The GRIM calculates cash flows using standard accounting principles and compares changes in INPV between the no-new-standards case and each standards case. The difference in INPV between the no-new-standards case and a standards case represents the financial impact of the new or amended energy conservation standard on manufacturers. As discussed previously, DOE developed critical GRIM inputs using a number of sources, including publicly available data, results of the engineering analysis, results of the shipments analysis, and information gathered from industry stakeholders during the course of manufacturer interviews. The GRIM results are presented in section V.B.2 of this document. Additional details about the GRIM, the discount rate, and other financial parameters can be found in chapter 12 of the NOPR TSD.

a. Manufacturer Production Costs

Manufacturing more efficient equipment is typically more expensive than manufacturing baseline equipment due to the use of more complex components, which are typically more costly than baseline components. The changes in the MPCs of covered equipment can affect the revenues, gross margins, and cash flow of the industry. In this rulemaking, DOE relies on a design-option approach for doors, panels, dedicated condensing units, and single-packaged dedicated systems. DOE relies on both a design-option and an efficiency-level approach for unit coolers, depending on the equipment class. For a complete description of the MPCs, see chapter 5 of the NOPR TSD or section IV.C of this document.

b. Shipments Projections

The GRIM estimates manufacturer revenues based on total unit shipment projections and the distribution of those shipments by efficiency level. Changes in sales volumes and efficiency mix over time can significantly affect manufacturer finances. For this analysis, the GRIM uses the NIA's annual shipment projections derived from the shipments analysis from 2023 (the base year) to 2056 (the end year of the analysis period). The shipments model takes an accounting approach, tracking market shares of each equipment class and the vintage of units in the stock. Stock accounting uses equipment shipments as inputs to estimate the age distribution of in-service equipment stocks for all years.

To calculate projected shipments of each equipment type, DOE uses a two-step approach. In the first step, the annual shipments of completed WICF installations (also referred to as ''boxes'') installations of all types are calculated using a stock model, whose principal inputs are commercial floor space projections and the average lifetime of a WICF box. In the second step, the various types of refrigeration systems and envelopes are partitioned over the shipments of the entire market for boxes. See chapter 9 of the NOPR TSD for additional details or section IV.G of this document.

c. Capital and Product Conversion Costs

New or amended energy conservation standards could cause manufacturers to incur conversion costs to bring their production facilities and equipment

[63] U.S. Securities and Exchange Commission, *Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system.* Available at *www.sec.gov/edgar/search/* (last accessed February 14, 2023).

[64] U.S. Census Bureau, *Annual Survey of Manufactures.* ''Summary Statistics for Industry Groups and Industries in the U.S (2021).'' Available at: *www.census.gov/data/tables/time-series/econ/asm/2018-2021-asm.html* (Last accessed February 14, 2023).

[65] The Dun & Bradstreet Hoovers login is available at: *app.dnbhoovers.com* (Last accessed February 17, 2023).

designs into compliance. DOE evaluated the level of conversion-related expenditures that would be needed to comply with each considered efficiency level in each equipment class. For the MIA, DOE classified these conversion costs into two major groups: (1) capital conversion costs; and (2) product conversion costs. Capital conversion costs are investments in property, plant, and equipment necessary to adapt or change existing production facilities such that new compliant equipment designs can be fabricated and assembled. Product conversion costs are investments in research, development, testing, marketing, and other non-capitalized costs necessary to make equipment designs comply with new or amended energy conservation standards.

DOE relied on information derived from manufacturer interviews, equipment teardown analysis, and the engineering models, as well as data collected in support of the June 2014 Final Rule, to evaluate the level of capital and product conversion costs manufacturers would likely incur at the considered standard levels. In interviews, DOE asked manufacturers to estimate the capital conversion costs (*e.g.,* changes in production processes, equipment, and tooling) to implement the various design options. The data generated from the equipment teardown and engineering analyses were used to estimate the capital investment in equipment, tooling, and conveyor required of OEMs at each efficiency level, considering such factors as product design, raw materials, purchased components, and fabrication method. Changes in equipment, tooling, and conveyer, supplemented by feedback from confidential manufacturer interviews, were then used to estimate capital conversion costs. In interviews, DOE also asked manufacturers to estimate the redesign effort and engineering resources required at various efficiency levels to quantify the product conversion costs. Manufacturer data was aggregated to protect confidential information.

For manufacturers of refrigeration systems, DOE also included the costs associated with appendix C1, as finalized in the May 2023 TP Final Rule. 88 FR 28780. Using individual model counts from the CCD and the efficiency distribution assumptions in the shipments analysis, DOE estimated the industry costs associated with re-rating compliant models in accordance with appendix C1.

In general, DOE assumes all conversion-related investments occur between the year of publication of the final rule and the year by which manufacturers must comply with the new standard. The conversion cost figures used in the GRIM can be found in section V.B.2 of this document. For additional information on the estimated capital and product conversion costs, see chapter 12 of the NOPR TSD.

d. Manufacturer Markup Scenarios

MSPs include direct manufacturing production costs (*i.e.,* labor, materials, and overhead estimated in DOE's MPCs) and all non-production costs (*i.e.,* SG&A, R&D, and interest), along with profit. To calculate the MSPs in the GRIM, DOE applied manufacturer markups to the MPCs estimated in the engineering analysis for each equipment class and efficiency level. Modifying these manufacturer markups in the standards case yields different sets of impacts on manufacturers. For the MIA, DOE modeled two standards-case scenarios to represent uncertainty regarding the potential impacts on prices and profitability for manufacturers following the implementation of amended energy conservation standards: (1) a preservation of gross margin percentage scenario; and (2) a preservation of operating profit scenario. These scenarios lead to different manufacturer markup values that, when applied to the MPCs, result in varying revenue and cash flow impacts.

Under the preservation of gross margin percentage scenario, DOE applied an uniform ''gross margin percentage'' markup across all efficiency levels, which assumes that manufacturers would be able to maintain the same amount of profit as a percentage of revenues at all efficiency levels within an equipment class. If manufacturer production costs increase with efficiency, this scenario implies that the per-unit dollar profit will increase. DOE assumed a gross margin percentage of 31 percent for display doors, 33 percent for non-display doors, 24 percent for panels, and 26 percent for refrigeration systems.[66] Manufacturers tend to believe it is optimistic to assume that they would be able to maintain the same gross margin percentage if their production costs increase, particularly for minimally efficient products.

In the preservation of operating profit scenario, if the cost of production goes up under a standards case, manufacturers are generally required to reduce their manufacturer markups to a level that maintains base-case operating profit. DOE implemented this scenario in the GRIM by adjusting the manufacturer markups at each TSL to yield approximately the same earnings before interest and taxes in the standards case as in the no-new-standards case in the year after the expected compliance date of the amended standards. The implicit assumption behind this scenario is that the industry can only maintain its operating profit in absolute dollars after the standard takes effect. Therefore, operating profit in percentage terms is typically reduced between the no-new-standard case and the standards cases.

A comparison of industry financial impacts under the two markup scenarios is presented in section V.B.2.a of this document.

3. Manufacturer Interviews

DOE interviewed seven door manufacturers, including OEMs of display and non-display doors, three panel manufacturers, and four refrigeration system manufacturers. Some manufacturers interviewed produced more than one walk-in component. Participants included both small businesses and large manufacturers with a range of equipment offerings and market shares.

In interviews, DOE asked manufacturers to describe their major concerns regarding the potential for more stringent energy conservation standards for walk-ins. The following section highlights manufacturer concerns that helped inform the projected potential impacts of an amended standard on the industry. Manufacturer interviews are conducted under nondisclosure agreements (''NDAs''), so DOE does not document these discussions in the same way that it does public comments in the comment summaries and DOE's responses throughout the rest of this document.

a. Increasing Insulation Thickness

Manufacturers of non-display doors and panels expressed concern about the impact of increased insulation thickness on processing time, capital investment, equipment cost, and company profitability. In interviews, manufacturers stated that much of the existing production equipment is designed to produce non-display doors and panels 3.5 inches to 5 inches thick. Panels that are 6 inches thick are less common in the industry. Manufacturers stated that increasing insulation thickness to 5 inches or 6 inches would notably extend curing and processing times, potentially reducing

[66] The gross margin percentages of 31 percent, 33 percent, 24 percent, and 26 percent are based on manufacturer markups of 1.45, 1.50, 1.32, and 1.35, respectively.

manufacturing capacity. To maintain current production levels, some manufacturers stated that they would need to buy additional fixtures and presses to offset the added processing time. A standard that requires 6-inch-thick panels would involve significant additional investment by most manufacturers. Furthermore, some manufacturers asserted that the walk-in market is price sensitive and increasing insulation thickness would add product costs with minimal benefit to the consumer. Alternatively, absorbing these costs would significantly reduce profit margins.

b. Reduced Anti-Sweat Heat

In interviews, some door manufacturers expressed concern that more stringent standards would necessitate reduced anti-sweat heat power, which could lead to safety hazards in some settings. These manufacturers stated that doors are typically designed for a range of ambient conditions because store operating conditions deviate from humidity levels assumed in standard test conditions. These manufacturers asserted that lowering the energy use requirements would increase the risk of condensation, particularly in stores without adequate climate control or stores located in humid regions. Manufacturers stated that excessive condensation could lead to water pooling on the floor, which is a slip hazard.

c. Refrigerant Regulation

Nearly all refrigeration system manufacturers expressed concerns about their ability to meet more stringent energy conservation standards and comply with refrigerant regulation limiting the use of HFC and high-GWP refrigerants. First, manufacturers expressed concern about the regulatory uncertainty surrounding the transition to low-GWP refrigerants. Second, manufacturers shared that there is technical uncertainty about the performance of A2L refrigerants and their impact on system efficiency. Third, manufacturers stated that transitioning walk-in refrigeration systems to make use of A2L or A3 refrigerants requires a significant amount of engineering resources, laboratory testing time, and capital investment. Some manufacturers also manufacture other equipment, such as commercial refrigerators, refrigerator-freezers, and freezers, which are subject to both EPA and DOE regulations and would potentially require redesign during a similar timeframe as walk-ins. Nearly all manufacturers expressed concern that they would have neither the time nor the resources to complete the dual development necessary to comply with both more stringent DOE energy conservation standards and EPA regulations over a short duration. Specifically, manufacturers stated that there could be staffing and testing bandwidth constraints in the years leading up to EPA and DOE compliance deadlines. Some manufacturers said they are already struggling to find more laboratory capacity for evaluation and analysis, which would be further exacerbated should DOE adopt more stringent energy conservation standards.

4. Discussion of MIA Comments

In response to the June 2022 Preliminary Analysis, AHRI suggested that DOE consider the refrigerant transition and other relevant rulemakings in the regulatory burden evaluation, including the requirement to change chemicals in articles containing phenol, isopropylated phosphate (''PIP'') (3:1) and others. (AHRI, No. 39 at p. 6) Additionally, AHRI stated that to make the transition to flammable refrigerants, manufacturers report capital expenditure estimates of $0.5 to $1.0 million for small facilities and $2.0 to $4.0 million for medium and larger facilities and equipment for spark-proof and explosion-proof equipment and design. (AHRI, No. 39 at p. 5)

DOE analyzes cumulative regulatory burden pursuant to section 13(g) of appendix A. Pursuant to section 13(g) of appendix A, the Department will analyze and consider the impact on manufacturers of multiple product/equipment-specific Federal regulatory actions. Regarding potential refrigerant regulation, DOE understands that manufacturers of walk-in refrigeration systems will likely need to transition to alternative, low-GWP refrigerants to comply with anticipated refrigeration regulations, such as the December 2022 AIM NOPR, prior to the expected 2027 compliance date of potential energy conservation standards. 87 FR 76738. While DOE did not consider the refrigerant transition costs to be conversion costs, as the change in refrigerant is independent of DOE actions related to any amended energy conservation standards, DOE did incorporate the estimated costs associated with redesigning walk-in refrigeration systems to make use of flammable refrigerants and upgrading production facilities to accommodate flammable refrigerants in the GRIM. DOE relied on manufacturer feedback in confidential interviews, a report prepared for EPA,[67] and AHRI's written comments to estimate the industry refrigerant transition costs. See subsection ''Refrigerants Analyzed'' of section IV.C.1.d of this document for additional discussion on the analyzed refrigerants in this NOPR and chapter 12 of the NOPR TSD for additional discussion on cumulative regulatory burden. Regarding chemical regulations, such as EPA's final rule prohibiting the processing and distribution of PIP (3:1) and PIP (3:1)-containing products, DOE did not consider these regulations in its NOPR cumulative regulatory burden analysis as EPA's final rule is not a walk-in-specific Federal regulatory action. 86 FR 894.

In response to the June 2022 Preliminary Analysis, AHRI commented that DOE should be aware that many independent custom cellar and cabinet builders could be impacted by amended energy conservation standards for WICFs. (AHRI-Wine, No. 39 at p. 5)

DOE notes that similar comments were made by a high-temperature refrigeration system manufacturer during confidential interviews. As discussed in section IV.B, DOE understands that design options that necessitate a significant change in system size could impact custom wine cellar designs since high-temperature walk-ins may be space-constrained. DOE has tentatively determined that consumers would lose the utility of compact high-temperature refrigeration systems if the evaporator or condenser heat exchangers underwent a considerable increase in size. Therefore, DOE is proposing to screen out improved evaporator and condenser coils for high-temperature refrigeration systems on the grounds of customer utility due to the additional heat exchanger size needed for this technology option. See IV.B of this document or chapter 4 of the NOPR TSD for additional details on the screening analysis.

K. Emissions Analysis

The emissions analysis consists of two components. The first component estimates the effect of potential energy conservation standards on power sector and site (where applicable) combustion emissions of CO_2, NO_X, SO_2, and Hg. The second component estimates the impacts of potential standards on emissions of two additional greenhouse gases, CH_4 and N_2O, as well as the

[67] *See* pp. 5–113 of the ''Global Non-CO_2 Greenhouse Gas Emission Projections & Marginal Abatement Cost Analysis: Methodology Documentation'' (2019). *www.epa.gov/sites/default/files/2019-09/documents/nonco2_methodology_report.pdf.*

reductions to emissions of other gases due to ''upstream'' activities in the fuel production chain. These upstream activities comprise extraction, processing, and transporting fuels to the site of combustion.

The analysis of electric power sector emissions of CO_2, NO_X, SO_2, and Hg uses emissions factors intended to represent the marginal impacts of the change in electricity consumption associated with amended or new standards. The methodology is based on results published for the *AEO,* including a set of side cases that implement a variety of efficiency-related policies. The methodology is described in appendix 13A in the NOPR TSD. The analysis presented in this notice uses projections from *AEO2023.* Power sector emissions of CH_4 and N_2O from fuel combustion are estimated using Emission Factors for Greenhouse Gas Inventories published by the EPA.[68]

FFC upstream emissions, which include emissions from fuel combustion during extraction, processing, and transportation of fuels, and ''fugitive'' emissions (direct leakage to the atmosphere) of CH_4 and CO_2, are estimated based on the methodology described in chapter 15 of the NOPR TSD.

The emissions intensity factors are expressed in terms of physical units per MWh or MMBtu of site energy savings. For power sector emissions, specific emissions intensity factors are calculated by sector and end use. Total emissions reductions are estimated using the energy savings calculated in the NIA.

1. Air Quality Regulations Incorporated in DOE's Analysis

DOE's no-new-standards case for the electric power sector reflects the *AEO,* which incorporates the projected impacts of existing air quality regulations on emissions. *AEO2023* reflects, to the extent possible, laws and regulations adopted through mid-November 2022, including the emissions control programs discussed in the following paragraphs the emissions control programs discussed in the following paragraphs, and the Inflation Reduction Act.[69] SO_2 emissions from affected electric generating units (''EGUs'') are subject to nationwide and regional emissions cap-and-trade programs. Title IV of the Clean Air Act sets an annual emissions cap on SO_2 for affected EGUs in the 48 contiguous States and the District of Columbia (DC). (42 U.S.C. 7651 *et seq.*) SO_2 emissions from numerous States in the eastern half of the United States are also limited under the Cross-State Air Pollution Rule (''CSAPR''). 76 FR 48208 (Aug. 8, 2011). CSAPR requires these States to reduce certain emissions, including annual SO_2 emissions, and went into effect as of January 1, 2015.[70] *AEO2023* incorporates implementation of CSAPR, including the update to the CSAPR ozone season program emission budgets and target dates issued in 2016. 81 FR 74504 (Oct. 26, 2016). Compliance with CSAPR is flexible among EGUs and is enforced through the use of tradable emissions allowances. Under existing EPA regulations, any excess SO_2 emissions allowances resulting from the lower electricity demand caused by the adoption of an efficiency standard could be used to permit offsetting increases in SO_2 emissions by another regulated EGU.

However, beginning in 2016, SO_2 emissions began to fall as a result of the Mercury and Air Toxics Standards (''MATS'') for power plants.[71] 77 FR 9304 (Feb. 16, 2012). In the MATS final rule, EPA established a standard for hydrogen chloride as a surrogate for acid gas hazardous air pollutants (''HAP''), and also established a standard for SO_2 (a non-HAP acid gas) as an alternative equivalent surrogate standard for acid gas HAP. The same controls are used to reduce HAP and non-HAP acid gas; thus, SO_2 emissions are being reduced as a result of the control technologies installed on coal-fired power plants to comply with the MATS requirements for acid gas. Because of the emissions reductions under the MATS, it is unlikely that excess SO_2 emissions allowances resulting from the lower electricity demand would be needed or used to permit offsetting increases in SO_2 emissions by another regulated EGU. Therefore, energy conservation standards that decrease electricity generation would generally reduce SO_2 emissions. DOE estimated SO_2 emissions reduction using emissions factors based on *AEO2023.*

CSAPR also established limits on NO_X emissions for numerous States in the eastern half of the United States. Energy conservation standards would have little effect on NO_X emissions in those States covered by CSAPR emissions limits if excess NO_X emissions allowances resulting from the lower electricity demand could be used to permit offsetting increases in NO_X emissions from other EGUs. In such case, NO_X emissions would remain near the limit even if electricity generation goes down. A different case could possibly result, depending on the configuration of the power sector in the different regions and the need for allowances, such that NO_X emissions might not remain at the limit in the case of lower electricity demand. In this case, energy conservation standards might reduce NO_X emissions in covered States. Despite this possibility, DOE has chosen to be conservative in its analysis and has maintained the assumption that standards will not reduce NO_X emissions in States covered by CSAPR. Energy conservation standards would be expected to reduce NO_X emissions in the States not covered by CSAPR. DOE used *AEO2023* data to derive NO_X emissions factors for the group of States not covered by CSAPR.

The MATS limit mercury emissions from power plants, but they do not include emissions caps and, as such, DOE's energy conservation standards would be expected to slightly reduce Hg emissions. DOE estimated mercury emissions reduction using emissions factors based on *AEO2023,* which incorporates the MATS.

L. Monetizing Emissions Impacts

As part of the development of this proposed rule, for the purpose of complying with the requirements of Executive Order 12866, DOE considered the estimated monetary benefits from the reduced emissions of CO_2, CH_4, N_2O, NO_X, and SO_2 that are expected to result from each of the TSLs considered. In order to make this calculation analogous to the calculation of the NPV of consumer benefit, DOE considered the reduced emissions expected to result over the lifetime of products shipped in the projection period for each TSL. This section summarizes the basis for the values used for monetizing

[68] Available at *www.epa.gov/sites/production/files/2021-04/documents/emission-factors_apr2021.pdf* (last accessed April 17, 2023).

[69] For further information, see the Assumptions to *AEO2023* report that sets forth the major assumptions used to generate the projections in the Annual Energy Outlook. Available at *www.eia.gov/outlooks/aeo/assumptions/* (last accessed April 17, 2023).

[70] CSAPR requires states to address annual emissions of SO_2 and NO_X, precursors to the formation of fine particulate matter ($PM_{2.5}$) pollution, in order to address the interstate transport of pollution with respect to the 1997 and 2006 $PM_{2.5}$ National Ambient Air Quality Standards (''NAAQS''). CSAPR also requires certain states to address the ozone season (May–September) emissions of NO_X, a precursor to the formation of ozone pollution, in order to address the interstate transport of ozone pollution with respect to the 1997 ozone NAAQS. 76 FR 48208 (Aug. 8, 2011). EPA subsequently issued a supplemental rule that included an additional five states in the CSAPR ozone season program; 76 FR 80760 (Dec. 27, 2011) (Supplemental Rule).

[71] In order to continue operating, coal power plants must have either flue gas desulfurization or dry sorbent injection systems installed. Both technologies, which are used to reduce acid gas emissions, also reduce SO_2 emissions.

the emissions benefits and presents the values considered in this NOPR.

To monetize the benefits of reducing GHG emissions, this analysis uses the interim estimates presented in the *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990* published in February 2021 by the IWG.

1. Monetization of Greenhouse Gas Emissions

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

DOE exercises its own judgment in presenting monetized climate benefits as recommended by applicable Executive orders, and DOE would reach the same conclusion presented in this proposed rulemaking in the absence of the social cost of greenhouse gases. That is, the social costs of greenhouse gases, whether measured using the February 2021 interim estimates presented by the Interagency Working Group on the Social Cost of Greenhouse Gases or by another means, did not affect the rule ultimately proposed by DOE.

DOE estimated the global social benefits of CO_2, CH_4, and N_2O reductions using SC–GHG values that were based on the interim values presented in the *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990,* published in February 2021 by the IWG (''February 2021 SC–GHG TSD''). The SC–GHGs is the monetary value of the net harm to society associated with a marginal increase in emissions in a given year, or the benefit of avoiding that increase. In principle, SC–GHGs includes the value of all climate change impacts, including (but not limited to) changes in net agricultural productivity, human health effects, property damage from increased flood risk and natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services. The SC–GHGs therefore, reflects the societal value of reducing emissions of the gas in question by one metric ton. The SC–GHGs is the theoretically appropriate value to use in conducting benefit-cost analyses of policies that affect CO_2, N_2O and CH_4 emissions. As a member of the IWG involved in the development of the February 2021 SC–GHG TSD, DOE agrees that the interim SC–GHG estimates represent the most appropriate estimate of the SC–GHG until revised estimates have been developed reflecting the latest, peer-reviewed science.

The SC–GHGs estimates presented here were developed over many years, using transparent process, peer-reviewed methodologies, the best science available at the time of that process, and with input from the public. Specifically, in 2009, the IWG, that included the DOE and other executive branch agencies and offices was established to ensure that agencies were using the best available science and to promote consistency in the social cost of carbon (''SC–CO_2'') values used across agencies. The IWG published SC–CO_2 estimates in 2010 that were developed from an ensemble of three widely cited integrated assessment models (''IAMs'') that estimate global climate damages using highly aggregated representations of climate processes and the global economy combined into a single modeling framework. The three IAMs were run using a common set of input assumptions in each model for future population, economic, and CO_2 emissions growth, as well as equilibrium climate sensitivity—a measure of the globally averaged temperature response to increased atmospheric CO_2 concentrations. These estimates were updated in 2013 based on new versions of each IAM. In August 2016 the IWG published estimates of the social cost of methane (''SC–CH_4'') and nitrous oxide (''SC–N_2O'') using methodologies that are consistent with the methodology underlying the SC–CO_2 estimates. The modeling approach that extends the IWG SC–CO_2 methodology to non-CO_2 GHGs has undergone multiple stages of peer review. The SC–CH_4 and SC–N_2O estimates were developed by Marten *et al.*[72] and underwent a standard double-blind peer review process prior to journal publication. In 2015, as part of the response to public comments received to a 2013 solicitation for comments on the SC–CO_2 estimates, the IWG announced a National Academies of Sciences, Engineering, and Medicine review of the SC–CO_2 estimates to offer advice on how to approach future updates to ensure that the estimates continue to reflect the best available science and methodologies. In January 2017, the National Academies released their final report, Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide, and recommended specific criteria for future updates to the SC–CO_2 estimates, a modeling framework to satisfy the specified criteria, and both near-term updates and longer-term research needs pertaining to various components of the estimation process.[73] Shortly thereafter, in March 2017, President Trump issued Executive Order 13783, which disbanded the IWG, withdrew the previous TSDs, and directed agencies to ensure SC–CO_2 estimates used in regulatory analyses are consistent with the guidance contained in OMB's Circular A–4, ''including with respect to the consideration of domestic versus international impacts and the consideration of appropriate discount rates'' (Executive Order (''E.O.'') 13783, Section 5(c)). Benefit-cost analyses following E.O. 13783 used SC–GHG estimates that attempted to focus on the U.S.-specific share of climate change damages as estimated by the models and were calculated using two discount rates recommended by Circular A–4, 3 percent and 7 percent. All other methodological decisions and model versions used in SC–GHG calculations remained the same as those used by the IWG in 2010 and 2013, respectively.

On January 20, 2021, President Biden issued E.O. 13990, which re-established the IWG and directed it to ensure that the U.S. Government's estimates of the social cost of carbon and other greenhouse gases reflect the best available science and the recommendations in the national Academies 2017 report. The IWG was tasked with first reviewing the SC–GHG estimates currently used in Federal analyses and publishing interim estimates within 30 days of the E.O. that reflect the full impact of GHG emissions, including by taking global damages into account. The interim SC–GHG estimates published in February 2021 are used here to estimate the climate benefits for this proposed rulemaking. The E.O. instructs the IWG

[72] Marten, A. L., E. A. Kopits, C. W. Griffiths, S. C. Newbold, and A. Wolverton. Incremental CH_4 and N_2O mitigation benefits consistent with the U.S. Government's SC–CO_2 estimates. *Climate Policy.* 2015. 15(2): pp. 272–298.

[73] National Academies of Sciences, Engineering, and Medicine. *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide.* 2017. The National Academies Press: Washington, DC. *nap.nationalacademies.org/catalog/24651/valuing-climate-damages-updating-estimation-of-the-social-cost-of.*

to undertake a fuller update of the SC–GHG estimates that takes into consideration the advice in the National Academies 2017 report and other recent scientific literature. The February 2021 SC–GHG TSD provides a complete discussion of the IWG's initial review conducted under E.O.13990. In particular, the IWG found that the SC–GHG estimates used under E.O. 13783 fail to reflect the full impact of GHG emissions in multiple ways.

First, the IWG found that the SC–GHG estimates used under E.O. 13783 fail to fully capture many climate impacts that affect the welfare of U.S. citizens and residents, and those impacts are better reflected by global measures of the SC–GHG. Examples of omitted effects from the E.O. 13783 estimates include direct effects on U.S. citizens, assets, and investments located abroad, supply chains, U.S. military assets and interests abroad, and tourism, and spillover pathways such as economic and political destabilization and global migration that can lead to adverse impacts on U.S. national security, public health, and humanitarian concerns. In addition, assessing the benefits of U.S. GHG mitigation activities requires consideration of how those actions may affect mitigation activities by other countries, as those international mitigation actions will provide a benefit to U.S. citizens and residents by mitigating climate impacts that affect U.S. citizens and residents. A wide range of scientific and economic experts have emphasized the issue of reciprocity as support for considering global damages of GHG emissions. If the United States does not consider impacts on other countries, it is difficult to convince other countries to consider the impacts of their emissions on the United States. The only way to achieve an efficient allocation of resources for emissions reduction on a global basis—and so benefit the U.S. and its citizens—is for all countries to base their policies on global estimates of damages. As a member of the IWG involved in the development of the February 2021 SC–GHG TSD, DOE agrees with this assessment and, therefore, in this proposed rule DOE centers attention on a global measure of SC–GHG. This approach is the same as that taken in DOE regulatory analyses from 2012 through 2016. A robust estimate of climate damages that accrue only to U.S. citizens and residents does not currently exist in the literature. As explained in the February 2021 TSD, existing estimates are both incomplete and an underestimate of total damages that accrue to the citizens and residents of the U.S. because they do not fully capture the regional interactions and spillovers discussed above, nor do they include all of the important physical, ecological, and economic impacts of climate change recognized in the climate change literature. As noted in the February 2021 SC–GHG TSD, the IWG will continue to review developments in the literature, including more robust methodologies for estimating a U.S.-specific SC–GHG value, and explore ways to better inform the public of the full range of carbon impacts. As a member of the IWG, DOE will continue to follow developments in the literature pertaining to this issue.

Second, the IWG found that the use of the social rate of return on capital (7 percent under current OMB Circular A–4 guidance) to discount the future benefits of reducing GHG emissions inappropriately underestimates the impacts of climate change for the purposes of estimating the SC–GHG. Consistent with the findings of the National Academies and the economic literature, the IWG continued to conclude that the consumption rate of interest is the theoretically appropriate discount rate in an intergenerational context,[74] and recommended that discount rate uncertainty and relevant aspects of intergenerational ethical considerations be accounted for in selecting future discount rates.

Furthermore, the damage estimates developed for use in the SC–GHG are estimated in consumption-equivalent terms, and so an application of OMB Circular A–4's guidance for regulatory analysis would then use the consumption discount rate to calculate the SC–GHG. DOE agrees with this assessment and will continue to follow developments in the literature pertaining to this issue. DOE also notes that while OMB Circular A–4, as published in 2003, recommends using 3% and 7% discount rates as ''default'' values, Circular A–4 also reminds agencies that ''different regulations may call for different emphases in the analysis, depending on the nature and complexity of the regulatory issues and the sensitivity of the benefit and cost estimates to the key assumptions.'' On discounting, Circular A–4 recognizes that ''special ethical considerations arise when comparing benefits and costs across generations,'' and Circular A–4 acknowledges that analyses may appropriately ''discount future costs and consumption benefits . . . at a lower rate than for intragenerational analysis.'' In the 2015 Response to Comments on the Social Cost of Carbon for Regulatory Impact Analysis, OMB, DOE, and the other IWG members recognized that ''Circular A–4 is a living document'' and ''the use of 7 percent is not considered appropriate for intergenerational discounting. There is wide support for this view in the academic literature, and it is recognized in Circular A–4 itself.'' Thus, DOE concludes that a 7% discount rate is not appropriate to apply to value the social cost of greenhouse gases in the analysis presented in this analysis.

To calculate the present and annualized values of climate benefits, DOE uses the same discount rate as the rate used to discount the value of damages from future GHG emissions, for internal consistency. That approach to discounting follows the same approach that the February 2021 TSD recommends ''to ensure internal consistency—*i.e.,* future damages from climate change using the SC–GHG at 2.5 percent should be discounted to the base year of the analysis using the same 2.5 percent rate.'' DOE has also consulted the National Academies' 2017 recommendations on how SC–GHG estimates can ''be combined in RIAs with other cost and benefits estimates that may use different discount rates.'' The National Academies reviewed several options, including ''presenting all discount rate combinations of other costs and benefits with [SC–GHG] estimates.''

As a member of the IWG involved in the development of the February 2021 SC–GHG TSD, DOE agrees with the above assessment and will continue to follow developments in the literature pertaining to this issue. While the IWG works to assess how best to incorporate the latest, peer-reviewed science to

[74] Interagency Working Group on Social Cost of Carbon. *Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866.* 2010. United States Government. (Last accessed April 17, 2023.) *www.epa.gov/sites/default/files/2016-12/documents/scc_tsd_2010.pdf;* Interagency Working Group on Social Cost of Carbon. *Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866.* 2013. (Last accessed April 17, 2023.) *www.federalregister.gov/documents/2013/11/26/2013-28242/technical-support-document-technical-update-of-the-social-cost-of-carbon-for-regulatory-impact;* Interagency Working Group on Social Cost of Greenhouse Gases, United States Government. Technical Support Document: Technical Update on the Social Cost of Carbon for Regulatory Impact Analysis-Under Executive Order 12866. August 2016. (Last accessed April 17, 2023.) *www.epa.gov/sites/default/files/2016-12/documents/sc_co2_tsd_august_2016.pdf;* Interagency Working Group on Social Cost of Greenhouse Gases, United States Government. Addendum to Technical Support Document on Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866: Application of the Methodology to Estimate the Social Cost of Methane and the Social Cost of Nitrous Oxide. August 2016. (Last accessed April 17, 2023.) *www.epa.gov/sites/default/files/2016-12/documents/addendum_to_sc-ghg_tsd_august_2016.pdf.*

develop an updated set of SC–GHG estimates, it set the interim estimates to be the most recent estimates developed by the IWG prior to the group being disbanded in 2017. The estimates rely on the same models and harmonized inputs and are calculated using a range of discount rates. As explained in the February 2021 SC–GHG TSD, the IWG has recommended that agencies revert to the same set of four values drawn from the SC–GHG distributions based on three discount rates as were used in regulatory analyses between 2010 and 2016 and were subject to public comment. For each discount rate, the IWG combined the distributions across models and socioeconomic emissions scenarios (applying equal weight to each) and then selected a set of four values recommended for use in benefit-cost analyses: an average value resulting from the model runs for each of three discount rates (2.5 percent, 3 percent, and 5 percent), plus a fourth value, selected as the 95th percentile of estimates based on a 3 percent discount rate. The fourth value was included to provide information on potentially higher-than-expected economic impacts from climate change. As explained in the February 2021 SC–GHG TSD, and DOE agrees, this update reflects the immediate need to have an operational SC–GHG for use in regulatory benefit-cost analyses and other applications that was developed using a transparent process, peer-reviewed methodologies, and the science available at the time of that process. Those estimates were subject to public comment in the context of dozens of proposed rulemakings as well as in a dedicated public comment period in 2013.

There are a number of limitations and uncertainties associated with the SC–GHG estimates. First, the current scientific and economic understanding of discounting approaches suggests discount rates appropriate for intergenerational analysis in the context of climate change are likely to be less than 3 percent, near 2 percent or lower.[75] Second, the IAMs used to produce these interim estimates do not include all of the important physical, ecological, and economic impacts of climate change recognized in the climate change literature and the science underlying their ‘‘damage functions’’—*i.e.,* the core parts of the IAMs that map global mean temperature changes and other physical impacts of climate change into economic (both market and nonmarket) damages—lags behind the most recent research. For example, limitations include the incomplete treatment of catastrophic and non-catastrophic impacts in the IAMs, their incomplete treatment of adaptation and technological change, the incomplete way in which inter-regional and intersectoral linkages are modeled, uncertainty in the extrapolation of damages to high-temperatures, and inadequate representation of the relationship between the discount rate and uncertainty in economic growth over long time horizons. Likewise, the socioeconomic and emissions scenarios used as inputs to the models do not reflect new information from the last decade of scenario generation or the full range of projections. The modeling limitations do not all work in the same direction in terms of their influence on the SC–CO_2 estimates. However, as discussed in the February 2021 TSD, the IWG has recommended that, taken together, the limitations suggest that the interim SC–GHG estimates used in this proposed rule likely underestimate the damages from GHG emissions. DOE concurs with this assessment.

DOE's derivations of the SC–CO_2, SC–N_2O, and SC–CH_4 values used for this NOPR are discussed in the following sections, and the results of DOE's analyses estimating the benefits of the reductions in emissions of these GHGs are presented in section IV.L.2 of this document.

a. Social Cost of Carbon

The SC–CO_2 values used for this NOPR were based on the values developed for the IWG's February 2021 TSD, which are shown in Table IV.47 in five-year increments from 2020 to 2050. The set of annual values that DOE used, which was adapted from estimates published by EPA,[76] is presented in Appendix 14A of the final rule TSD. These estimates are based on methods, assumptions, and parameters identical to the estimates published by the IWG (which were based on EPA modeling), and include values for 2051 to 2070. DOE expects additional climate benefits to accrue for products still operating after 2070, but a lack of available SC–CO_2 estimates for emissions years beyond 2070 prevents DOE from monetizing these potential benefits in this analysis.

TABLE IV.47—ANNUAL SC–CO_2 VALUES FROM 2021 INTERAGENCY UPDATE, 2020–2050

[2020$ Per metric ton CO_2]

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

DOE multiplied the CO_2 emissions reduction estimated for each year by the SC–CO_2 value for that year in each of the four cases. DOE adjusted the values to 2022$ using the implicit price deflator for gross domestic product (‘‘GDP’’) from the Bureau of Economic Analysis. To calculate a present value of the stream of monetary values, DOE

[75] Interagency Working Group on Social Cost of Greenhouse Gases (IWG). 2021. Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990. February. United States Government. Available at: *www.whitehouse.gov/briefing-room/blog/2021/02/26/a-return-to-science-evidence-based-estimates-of-the-benefits-of-reducing-climate-pollution/.*

[76] *See* EPA, Revised 2023 and Later Model Year Light-Duty Vehicle GHG Emissions Standards: Regulatory Impact Analysis, Washington, DC, December 2021. Available at *nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1013ORN.pdf* (last accessed February 21, 2023).

discounted the values in each of the four cases using the specific discount rate that had been used to obtain the SC–CO_2 values in each case.

b. Social Cost of Methane and Nitrous Oxide

The SC–CH_4 and SC–N_2O values used for this NOPR were based on the values developed for the February 2021 TSD. Table IV.48 shows the updated sets of SC–CH_4 and SC–N_2O estimates from the latest interagency update in 5-year increments from 2020 to 2050. The full set of annual values used is presented in Appendix 14–A of the NOPR TSD. To capture the uncertainties involved in regulatory impact analysis, DOE has determined it is appropriate to include all four sets of SC–CH_4 and SC–N_2O values, as recommended by the IWG. DOE derived values after 2050 using the approach described above for the SC–CO_2.

TABLE IV.48—ANNUAL SC–CH_4 AND SC–N_2O VALUES FROM 2021 INTERAGENCY UPDATE, 2020–2050

[2020$ Per metric ton]

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

DOE multiplied the CH_4 and N_2O emissions reduction estimated for each year by the SC–CH_4 and SC–N_2O estimates for that year in each of the cases. DOE adjusted the values to 2022$ using the implicit price deflator for gross domestic product (''GDP'') from the Bureau of Economic Analysis. To calculate a present value of the stream of monetary values, DOE discounted the values in each of the cases using the specific discount rate that had been used to obtain the SC–CH_4 and SC–N_2O estimates in each case.

2. Monetization of Other Emissions Impacts

For the NOPR, DOE estimated the monetized value of NO_X and SO_2 emissions reductions from electricity generation using the latest benefit-per-ton estimates for that sector from the EPA's Benefits Mapping and Analysis Program.[77] DOE used EPA's values for $PM_{2.5}$-related benefits associated with NO_X and SO_2 and for ozone-related benefits associated with NO_X for 2025 2030, and 2040, calculated with discount rates of 3 percent and 7 percent. DOE used linear interpolation to define values for the years not given in the 2025 to 2040 period; for years beyond 2040 the values are held constant. DOE combined the EPA regional benefit-per-ton estimates with regional information on electricity consumption and emissions from AEO2023 to define weighted-average national values for NO_X and SO_2 (see appendix 14B of the NOPR TSD).

DOE also estimated the monetized value of NO_X and SO_2 emissions reductions from site use of natural gas in walk-in coolers and freezers using benefit-per-ton estimates from the EPA's Benefits Mapping and Analysis Program. Although none of the sectors covered by EPA refers specifically to residential and commercial buildings, the sector called ''area sources'' would be a reasonable proxy for residential and commercial buildings.[78] The EPA document provides high and low estimates for 2025 and 2030 at 3- and 7-percent discount rates.[79] DOE used the same linear interpolation and extrapolation as it did with the values for electricity generation.

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

M. Utility Impact Analysis

The utility impact analysis estimates the changes in installed electrical capacity and generation projected to result for each considered TSL. The analysis is based on published output from the NEMS associated with *AEO2023.* NEMS produces the *AEO* Reference case, as well as a number of side cases that estimate the economy-wide impacts of changes to energy supply and demand. For the current analysis, impacts are quantified by comparing the levels of electricity sector generation, installed capacity, fuel consumption and emissions in the *AEO2023* Reference case and various side cases. Details of the methodology are provided in the appendices to chapters 13 and 15 of the NOPR TSD.

The output of this analysis is a set of time-dependent coefficients that capture the change in electricity generation, primary fuel consumption, installed capacity and power sector emissions due to a unit reduction in demand for a given end use. These coefficients are multiplied by the stream of electricity savings calculated in the NIA to provide estimates of selected utility impacts of potential new or amended energy conservation standards.

N. Employment Impact Analysis

DOE considers employment impacts in the domestic economy as one factor in selecting a proposed standard. Employment impacts from new or amended energy conservation standards include both direct and indirect impacts. Direct employment impacts are any changes in the number of employees of manufacturers of the equipment subject to standards. The MIA addresses those impacts. Indirect employment impacts are changes in national employment that occur due to

[77] U.S. Environmental Protection Agency. Estimating the Benefit per Ton of Reducing Directly-Emitted $PM_{2.5}$, $PM_{2.5}$ Precursors and Ozone precursors from 21 Sectors. *www.epa.gov/benmap/estimating-benefit-ton-reducing-directly-emitted-pm25-pm25-precursors-and-ozone-precursors.*

[78] ''Area sources'' represents all emission sources for which states do not have exact (point) locations in their emissions inventories. Because exact locations would tend to be associated with larger sources, ''area sources'' would be fairly representative of small dispersed sources like homes and businesses.

[79] ''Area sources'' are a category in the 2018 document from EPA, but are not used in the 2021 document cited above. See: *www.epa.gov/sites/default/files/2018-02/documents/sourceapportionmentbpttsd_2018.pdf.*

the shift in expenditures and capital investment caused by the purchase and operation of more-efficient appliances. Indirect employment impacts from standards consist of the net jobs created or eliminated in the national economy, other than in the manufacturing sector being regulated, caused by (1) reduced spending by consumers on energy, (2) reduced spending on new energy supply by the utility industry, (3) increased consumer spending on the products to which the new standards apply and other goods and services, and (4) the effects of those three factors throughout the economy.

One method for assessing the possible effects on the demand for labor of such shifts in economic activity is to compare sector employment statistics developed by the Labor Department's Bureau of Labor Statistics (''BLS''). BLS regularly publishes its estimates of the number of jobs per million dollars of economic activity in different sectors of the economy, as well as the jobs created elsewhere in the economy by this same economic activity. Data from BLS indicate that expenditures in the utility sector generally create fewer jobs (both directly and indirectly) than expenditures in other sectors of the economy.[80] There are many reasons for these differences, including wage differences and the fact that the utility sector is more capital-intensive and less labor-intensive than other sectors. Energy conservation standards have the effect of reducing consumer utility bills. Because reduced consumer expenditures for energy likely lead to increased expenditures in other sectors of the economy, the general effect of efficiency standards is to shift economic activity from a less labor-intensive sector (*i.e.,* the utility sector) to more labor-intensive sectors (*e.g.,* the retail and service sectors). Thus, the BLS data suggest that net national employment may increase due to shifts in economic activity resulting from energy conservation standards.

DOE estimated indirect national employment impacts for the standard levels considered in this NOPR using an input/output model of the U.S. economy called Impact of Sector Energy Technologies version 4 (''ImSET'').[81] ImSET is a special-purpose version of the ''U.S. Benchmark National Input-Output'' (''I–O'') model, which was designed to estimate the national employment and income effects of energy-saving technologies. The ImSET software includes a computer–based I–O model having structural coefficients that characterize economic flows among 187 sectors most relevant to industrial, commercial, and residential building energy use.

DOE notes that ImSET is not a general equilibrium forecasting model, and that the uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Because ImSET does not incorporate price changes, the employment effects predicted by ImSET may over-estimate actual job impacts over the long run for this rule. Therefore, DOE used ImSET only to generate results for near-term timeframes (2027–2036), where these uncertainties are reduced. For more details on the employment impact analysis, see chapter 16 of the NOPR TSD.

V. Analytical Results and Conclusions

The following section addresses the results from DOE's analyses with respect to the considered energy conservation standards for walk-in coolers and freezers. It addresses the TSLs examined by DOE, the projected impacts of each of these levels if adopted as energy conservation standards for walk-in coolers and freezers, and the standards levels that DOE is proposing to adopt in this NOPR. Additional details regarding DOE's analyses are contained in the NOPR TSD supporting this document.

A. Trial Standard Levels

In general, DOE typically evaluates potential new or amended standards for products and equipment by grouping individual efficiency levels for each class into TSLs. Use of TSLs allows DOE to identify and consider manufacturer cost interactions between the equipment classes, to the extent that there are such interactions, and price elasticity of consumer purchasing decisions that may change when different standard levels are set.

In the analysis conducted for this NOPR, DOE analyzed the benefits and burdens of three TSLs for walk-ins. DOE developed TSLs that combine efficiency levels for each analyzed equipment class, these TSL are discussed in section IV.E.1 of this document.

B. Economic Justification and Energy Savings

1. Economic Impacts on Individual Consumers

DOE analyzed the economic impacts on walk-in coolers and freezers consumers by looking at the effects that potential amended standards at each TSL would have on the LCC and PBP. DOE also examined the impacts of potential standards on selected consumer subgroups. These analyses are discussed in the following sections.

a. Life-Cycle Cost and Payback Period

In general, higher-efficiency products affect consumers in two ways: (1) purchase price increases and (2) annual operating costs decrease. Inputs used for calculating the LCC and PBP include total installed costs (*i.e.,* product price plus installation costs), and operating costs (*i.e.,* annual energy use, energy prices, energy price trends, repair costs, and maintenance costs). The LCC calculation also uses product lifetime and a discount rate. Chapter 8 of the NOPR TSD provides detailed information on the LCC and PBP analyses.

Table V.1 through Table V.56 show the LCC and PBP results for the TSLs considered for each equipment class. In the first of each pair of tables, the simple payback is measured relative to the baseline product. In the second table, impacts are measured relative to the efficiency distribution in the no-new-standards case in the compliance year (see section III.E of this document). Because some consumers purchase equipment with higher efficiency in the no-new-standards case, the average savings are less than the difference between the average LCC of the baseline product and the average LCC at each TSL. The savings refer only to consumers who are affected by a standard at a given TSL. Those who already purchase a product with efficiency at or above a given TSL are not affected. Consumers for whom the LCC increases at a given TSL experience a net cost.

Doors

[80] See U.S. Department of Commerce–Bureau of Economic Analysis. *Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II).* 1997. U.S. Government Printing Office: Washington, DC. Available at *https://apps.bea.gov/scb/pdf/regional/perinc/meth/rims2.pdf* (last accessed April 27, 2023).

[81] Livingston, O.V., S.R. Bender, M.J. Scott, and R.W. Schultz. *ImSET 4.0: Impact of Sector Energy Technologies Model Description and User Guide.* 2015. Pacific Northwest National Laboratory: Richland, WA. PNNL–24563.

TABLE V.1—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: DW.L

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	3,101	260	2,160	5,261		12.1
1	3,101	257	2,136	5,237		12.1
2	3,101	256	2,132	5,233		12.1
3	4,463	210	1,747	6,210	44.0	12.1

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.2—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: DW.L

TSL	% Consumers with net cost	Average savings—impacted consumers (2022$)
1	0	
2	0	
3	100	−1,106

Note: The savings represent the average LCC for affected consumers.

TABLE V.3—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: DW.M

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	2,888	75	615	3,504		12.0
1	2,888	74	607	3,495		12.0
2	2,888	73	605	3,493		12.0
3	4,248	53	436	4,684	99.1	12.0

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.4—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: DW.M

TSL	% Consumers with net cost	Average savings—impacted consumers (2022$)
1	0	
2	0	
3	100	−1,247

Note: The savings represent the average LCC for affected consumers.

TABLE V.5—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: NM.L

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	2,574	368	2,219	4,793		8.0
1	2,833	164	992	3,825	1.3	8.0
2	2,833	164	991	3,824	1.3	8.0
3	3,136	145	878	4,014	2.8	8.0

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.6—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: NM.L

TSL	% Consumers with net cost	Average savings—impacted consumers (2022$)
1	2	724
2	2	723
3	37	307

Note: The savings represent the average LCC for affected consumers.

TABLE V.7—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: NM.M

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	2,605	120	727	3,332		8.0
1	2,736	64	387	3,123	2.4	8.0
2	2,850	41	251	3,101	3.2	8.0
3	3,229	34	209	3,438	8.2	8.0

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.8—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: NM.M

TSL	% Consumers with net cost	Average savings—impacted consumers (2022$)
1	2	203
2	11	86
3	96	−291

Note: The savings represent the average LCC for affected consumers.

TABLE V.9—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: NO.L

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	7,102	516	3,089	10,191		7.9
1	7,363	247	1,480	8,844	1.0	7.9
2	7,363	246	1,478	8,841	1.0	7.9
3	7,688	212	1,276	8,964	2.1	7.9

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.10—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: NO.L

TSL	% Consumers with net cost	Average savings—impacted consumers (2022$)
1	1	1,194
2	2	1,192
3	9	932

Note: The savings represent the average LCC for affected consumers.

TABLE V.11—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: NO.M

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	7,059	168	1,014	8,073		8.0
1	7,190	94	568	7,758	1.8	8.0
2	7,307	63	383	7,690	2.4	8.0
3	7,704	51	311	8,015	6.3	8.0

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.12—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: NO.M

TSL	% Consumers with net cost	Average savings—impacted consumers (2022$)
1	0	306
2	3	113
3	95	−266

Note: The savings represent the average LCC for affected consumers.

Panels

TABLE V.13—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: PF.L PER ft^2

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	13.27	0.57	4.41	17.68		11.5
1	13.27	0.56	4.35	17.62		11.5
2	13.27	0.56	4.34	17.61		11.5
3	16.10	0.40	3.15	19.25	26.1	11.5

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.14—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: PF.L PER ft^2

TSL	% Consumers with net cost	Average savings—impacted consumers (2022$)
1	0	
2	0	
3	95	−1.61

Note: The savings represent the average LCC for affected consumers.

TABLE V.15—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: PS.L PER ft^2

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	13.31	0.93	7.23	20.54		11.6
1	13.31	0.91	7.12	20.43		11.6
2	13.31	0.91	7.11	20.41		11.6

TABLE V.15—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: PS.L PER ft²—Continued

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
3	16.18	0.55	4.33	20.51	10.1	11.6

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.16—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: PS.L PER ft²

TSL	% Consumers with net cost	Average savings—impacted consumers (2022$)
1	0	
2	0	
3	64	−0.50

Note: The savings represent the average LCC for affected consumers.

TABLE V.17—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: PS.M PER ft²

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	12.82	0.22	1.72	14.54		11.6
1	12.82	0.22	1.69	14.50		11.6
2	12.82	0.21	1.67	14.49		11.6
3	16.13	0.12	0.94	17.07	54.0	11.6

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.18—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: PS.M PER ft²

TSL	% Consumers with net cost	Average savings—impacted consumers (2022$)
1	0	
2	0	
3	100	−2.33

Note: The savings represent the average LCC for affected consumers.

Refrigeration Systems

TABLE V.19—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: DC.L.I

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	7,644	2,476	22,075	29,719		10.6
1	7,764	2,436	21,849	29,614	4.0	10.6
2	7,764	2,436	21,849	29,614	4.0	10.6

TABLE V.19—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: DC.L.I—Continued

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
3	11,192	2,434	23,745	34,937	−16.2	10.6

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.20—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: DC.L.I

TSL	% Consumers with net cost	Average savings—impacted consumers (2022$)
1	11	163
2	11	163
3	100	−5,218

Note: The savings represent the average LCC for affected consumers.

TABLE V.21—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: DC.L.O

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	26,565	3,788	39,834	66,399		10.5
1	26,618	3,745	39,544	66,162	1.4	10.5
2	26,720	3,732	39,507	66,227	3.6	10.5
3	38,663	3,323	43,528	82,191	−25.0	10.5

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.22—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: DC.L.O

TSL	% Consumers with net cost	Average savings—impacted consumers (2022$)
1	0	237
2	8	172
3	100	−15,792

Note: The savings represent the average LCC for affected consumers.

TABLE V.23—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: DC.M.I

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	3,801	1,157	10,327	14,128		10.5
1	3,916	1,113	10,065	13,982	3.4	10.5
2	3,916	1,113	10,065	13,982	3.4	10.5
3	5,401	1,113	10,775	16,175	−26.7	10.5

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.24—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: DC.M.I

TSL	% Consumers with net cost	Average savings—impacted consumers (2022$)
1	1	567
2	1	567
3	100	−2,047

Note: The savings represent the average LCC for affected consumers.

TABLE V.25—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: DC.M.O

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	5,803	1,651	15,078	20,881		10.6
1	5,829	1,632	14,951	20,780	1.6	10.6
2	5,872	1,618	14,873	20,745	2.6	10.6
3	8,771	1,300	14,006	22,777	21.6	10.6

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.26—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: DC.M.O

TSL	% Consumers with net cost	Average savings—impacted consumers (2022$)
1	0	101
2	1	136
3	96	−1,896

Note: The savings represent the average LCC for affected consumers.

TABLE V.27—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: SP.H.I

TSL	Average costs (2022$)				Simple Payback Period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	1,978	255	2,709	4,688		10.5
1	2,006	230	2,557	4,563	1.3	10.5
2	2,006	230	2,557	4,563	1.3	10.5
3	2,035	226	2,550	4,585	2.5	10.5

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.28—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: SP.H.I

TSL	% Consumers with net cost	Average savings—impacted consumers (2022$)
1	2	124
2	2	124
3	3	103

Note: The savings represent the average LCC for affected consumers.

TABLE V.29—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: SP.H.ID

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	2,051	436	3,977	6,027		10.5
1	2,145	370	3,586	5,731	1.7	10.5
2	2,145	370	3,586	5,731	1.7	10.5
3	2,145	370	3,586	5,731	1.7	10.5

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.30—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: SP.H.ID

TSL	% Consumers with net cost	Average savings—impacted consumers (2022$)
1	0	296
2	0	296
3	0	296

Note: The savings represent the average LCC for affected consumers.

TABLE V.31—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: SP.H.O

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	2,857	357	3,829	6,686		10.5
1	2,867	331	3,659	6,526	0.4	10.5
2	2,948	317	3,612	6,560	2.9	10.5
3	3,079	312	3,660	6,738	9.0	10.5

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.32—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: SP.H.O

TSL	% Consumers with net cost	Average savings—impacted consumers (2022$)
1	0	159
2	3	126
3	81	−53

Note: The savings represent the average LCC for affected consumers.

TABLE V.33—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: SP.H.OD

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	2,820	590	5,401	8,221		10.5
1	2,836	522	4,948	7,784	0.2	10.5
2	3,119	474	4,797	7,916	3.4	10.5
3	3,146	472	4,806	7,951	3.8	10.5

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.34—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: SP.H.OD

TSL	% Consumers with net cost	Average savings—impacted consumers (2022$)
1	0	437
2	4	305
3	13	270

Note: The savings represent the average LCC for affected consumers.

TABLE V.35—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: SP.L.I

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	3,722	743	7,026	10,748		10.5
1	3,939	666	6,630	10,568	3.8	10.5
2	3,939	666	6,630	10,568	3.8	10.5
3	5,223	643	7,100	12,323	inf	10.5

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.36—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: SP.L.I

TSL	% consumers with net cost	Average savings—impacted consumers (2022$)
1	7	180
2	7	180
3	100	−1,575

Note: The savings represent the average LCC for affected consumers.

TABLE V.37—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: SP.L.O

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	4,951	956	9,129	14,079		10.6
1	4,951	956	9,129	14,079		10.6
2	4,951	956	9,129	14,079		10.6
3	6,514	806	8,843	15,357	39.0	10.6

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.38—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: SP.L.O

TSL	% consumers with net cost	Average savings—impacted consumers (2022$)
1		
2		
3	100.0	−1,278

Note: The savings represent the average LCC for affected consumers.

TABLE V.39—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: SP.M.I

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	4,002	713	6,961	10,963		10.5
1	4,087	677	6,762	10,849	3.0	10.5
2	4,104	674	6,756	10,860	3.5	10.5
3	5,277	666	7,263	12,540	inf	10.5

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.40—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: SP.M.I

TSL	% consumers with net cost	Average savings— impacted consumers (2022$)
1	4	114
2	5	103
3	100	−1,577

Note: The savings represent the average LCC for affected consumers.

TABLE V.41—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: SP.M.O

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	4,795	668	7,032	11,826		10.5
1	4,821	635	6,820	11,641	0.9	10.5
2	4,830	634	6,819	11,649	1.2	10.5
3	6,093	549	6,848	12,942	50.8	10.5

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.42—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: SP.M.O

TSL	% consumers with net cost	Average savings— impacted consumers (2022$)
1	0	186
2	0	177
3	100	−1,116

Note: The savings represent the average LCC for affected consumers.

TABLE V.43—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: UC.H

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	3,083	483	4,626	7,709		10.5
1	3,083	483	4,626	7,709		10.5
2	3,083	483	4,626	7,709		10.5
3	3,201	478	4,660	7,861	inf	10.5

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.44—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: UC.H

TSL	% consumers with net cost	Average savings—impacted consumers (2022$)
1	....	....
2	....	....
3	61	−152

Note: The savings represent the average LCC for affected consumers.

TABLE V.45—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: UC.H.ID

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	3,161	719	6,377	9,538	....	10.5
1	3,188	679	6,113	9,301	0.7	10.5
2	3,188	679	6,113	9,301	0.7	10.5
3	3,188	679	6,113	9,301	0.7	10.5

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.46—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: UC.H.ID

TSL	% consumers with net cost	Average savings—impacted consumers (2022$)
1	0.0	237
2	0.0	237
3	0.0	237

Note: The savings represent the average LCC for affected consumers.

TABLE V.47—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: UC.L

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	2,658	4,413	34,322	36,980	....	10.5
1	2,801	4,239	33,099	35,900	0.9	10.5
2	2,908	4,186	32,766	35,674	1.2	10.5
3	2,908	4,186	32,766	35,674	1.2	10.5

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.48—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: UC.L

TSL	% Consumers with net cost	Average savings—impacted consumers (2022$)
1	3	1,080
2	8	1,306
3	8	1,306

Note: The savings represent the average LCC for affected consumers.

TABLE V.49—AVERAGE LCC AND PBP RESULTS FOR EQUIPMENT CLASS: UC.M

TSL	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	2,468	1,675	13,649	16,118		10.6
1	2,530	1,640	13,418	15,948	2.0	10.6
2	2,546	1,631	13,360	15,906	2.0	10.6
3	2,546	1,631	13,360	15,906	2.0	10.6

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.50—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR EQUIPMENT CLASS: UC.M

TSL	% Consumers with net cost	Average savings—impacted consumers (2022$)
1	9	170
2	10	212
3	10	212

Note: The savings represent the average LCC for affected consumers.

b. Consumer Subgroup Analysis

In the consumer subgroup analysis, DOE estimated the impact of the considered TSLs on high warm air-infiltration applications, and small businesses. Table V.51 through Table V.53 compare the average LCC savings and PBP at each efficiency level for the consumer subgroups with similar metrics for the reduced consumer sample for all equipment classes and representative units. In most cases, the average LCC savings and PBP for small business and applications with high amount of warm-air infiltration at the considered trial standard levels are not substantially different from the average for all consumers. In those cases where the results differ, the selected subgroups tend to have greater benefits due to in the case of the small business subgroup: higher electricity costs; and; in the case of the warm-air infiltration subgroup: increased hours of operation.

Chapter 11 of the NOPR TSD presents the complete LCC and PBP results for the subgroups.

TABLE V.51—COMPARISON OF LCC SAVINGS AND PBP FOR CONSUMER SUBGROUPS FOR WALK-IN DOORS

Equipment class	Reference			Small business		
	TSL 1	TSL 2	TSL 3	TSL 1	TSL 2	TSL 3
Consumer Average LCC Savings (2022$)						
DW.L			−1,106			−1,004
DW.M			−1,247			−1,206
NM.L	724	723	307	1,287	1,287	1,072
NM.M	203	86	−291	289	345	−5
NO.L	1,194	1,192	932	1,761	1,761	1,610
NO.M	306	113	−266	419	534	192
Consumer Simple PBP (years)						
DW.L			44.0			29.1
DW.M			99.1			67.0
NM.L	1.3	1.3	2.8	1.0	1.0	2.0
NM.M	2.4	3.2	8.2	1.8	2.4	5.7
NO.L	1.0	1.0	2.1	0.7	0.7	1.5
NO.M	1.8	2.4	6.3	1.4	1.8	4.4
Percent of Consumers that Experience a Net Cost						
DW.L			100			100
DW.M			100			100
NM.L	2	2	37	2	2	6
NM.M	2	11	96	6	7	51
NO.L	1	2	9	0	0	3
NO.M	0	3	95	2	5	28

TABLE V.52—COMPARISON OF LCC SAVINGS AND PBP FOR CONSUMER SUBGROUPS FOR WALK-IN PANELS

Equipment class	Reference			Small business		
	TSL 1	TSL 2	TSL 3	TSL 1	TSL 2	TSL 3
Consumer Average LCC Savings per ft² (2022$)						
PF.L			−1.61			−1.66
PS.L			−0.50			0.17
PS.M			−2.33			−2.61
Consumer Simple PBP (years)						
PF.L			26.1			17.4
PS.L			10.1			6.8
PS.M			54.0			33.6
Percent of Consumers that Experience a Net Cost (%)						
PS.M			95			100
PS.L			64			41
PS.M			100			100

TABLE V.53—COMPARISON OF LCC SAVINGS AND PBP FOR CONSUMER SUBGROUPS FOR WALK-IN REFRIGERATION SYSTEMS

Equipment class	Reference			Small businesses			Warm air		
	TSL 1	TSL 2	TSL 3	TSL 1	TSL 2	TSL 3	TSL 1	TSL 2	TSL 3
Consumer Average LCC Savings (2022$)									
DC.L.I	163	163	−5,218	256	256	−2,851	266	266	−5,138
DC.L.O	237	172	−15,792	243	191	−2,603	271	226	−15,238
DC.M.I	567	567	−2,047	763	763	−1,851	1,004	1,004	−1,932
DC.M.O	101	136	−1,896	−8	34	−1,331	−136	−41	−1,055
SP.H.I	124	124	103	124	124	103	180	180	167
SP.H.ID	296	296	296	297	297	297	446	446	446
SP.H.O	159	126	−53	159	125	−53	165	164	−3
SP.H.OD	437	305	270	439	307	272	540	518	485
SP.L.I	180	180	−1,575	180	180	−1,578	265	265	−1,461
SP.L.O			−1,278			−1,279			−1,121
SP.M.I	114	103	−1,577	114	92	−1,576	198	183	−1,467
SP.M.O	186	177	−1,116	186	177	−1,116	208	202	−898
UC.H			−152			−145			−141
UC.H.ID	237	237	237	263	263	263	320	320	320
UC.L	1,080	1,306	1,306	1,638	2,025	2,025	1,289	1,568	1,568
UC.M	170	212	212	273	341	341	235	293	293
Consumer Simple PBP (years)									
DC.L.I	4.0	4.0	inf	2.0	2.0	inf	3.1	3.1	inf
DC.L.O	1.4	3.6	inf	1.2	3.3	45.3	1.2	3.1	inf
DC.M.I	3.4	3.4	inf	2.1	2.1	inf	2.4	2.4	inf
DC.M.O	1.6	2.6	21.6	inf	3.0	22.2	inf	19.2	12.0
SP.H.I	1.3	1.3	2.5	1.3	1.3	2.4	0.9	0.9	1.7
SP.H.ID	1.7	1.7	1.7	1.7	1.7	1.7	1.2	1.2	1.2
SP.H.O	0.4	2.9	9.0	0.4	2.9	9.1	0.4	2.5	7.0
SP.H.OD	0.2	3.4	3.8	0.2	3.4	3.8	0.2	2.5	2.8
SP.L.I	3.8	3.8	inf	3.8	3.8	inf	3.2	3.2	291.4
SP.L.O			39.0			39.1			24.9
SP.M.I	3.0	3.5	inf	3.0	3.7	inf	2.1	2.5	inf
SP.M.O	0.9	1.2	50.8	0.9	1.1	50.7	0.8	1.0	22.9
UC.H			inf			inf			inf
UC.H.ID	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6
UC.L	0.9	1.2	1.2	0.5	0.7	0.7	0.7	1.0	1.0
UC.M	2.0	2.0	2.0	1.2	1.2	1.2	1.6	1.6	1.6
Percent of Consumers that Experience a Net Cost (%)									
DC.L.I	11	11	100	2	2	100	5	5	100
DC.L.O	0	8	100	0	4	100	0	5	100
DC.M.I	1	1	100	0	0	100	0	0	100
DC.M.O	0	1	96	23	23	95	38	29	85
SP.H.I	2	2	3	2	2	3	0	0	1
SP.H.ID	0	0	0	0	0	0	0	0	0
SP.H.O	0	3	81	0	3	81	0	2	56
SP.H.OD	0	4	13	0	4	13	0	2	5
SP.L.I	7	7	100	7	7	100	4	4	100
SP.L.O	0	0	100	0	0	100	0	0	100
SP.M.I	4	5	100	4	5	100	1	2	100

TABLE V.53—COMPARISON OF LCC SAVINGS AND PBP FOR CONSUMER SUBGROUPS FOR WALK-IN REFRIGERATION SYSTEMS—Continued

Equipment class	Reference			Small businesses			Warm air		
	TSL 1	TSL 2	TSL 3	TSL 1	TSL 2	TSL 3	TSL 1	TSL 2	TSL 3
SP.M.O	0	0	100	0	0	100	0	0	100
UC.H	0	0	61	0	0	47	0	0	41
UC.H.ID	0	0	0	0	0	0	0	0	0
UC.L	3	8	8	0	1	1	2	5	5
UC.M	9	10	10	0	1	1	7	7	7

c. Rebuttable Presumption Payback

As discussed in section IV.G of this document, EPCA establishes a rebuttable presumption that an energy conservation standard is economically justified if the increased purchase cost for a product that meets the standard is less than three times the value of the first-year energy savings resulting from the standard. In calculating a rebuttable presumption payback period for each of the considered TSLs, DOE used discrete values, and as required by EPCA, based the energy use calculation on the DOE test procedure for walk-in coolers and freezers. In contrast, the PBPs presented in section V.B.1.a of this document were calculated using distributions that reflect the range of energy use in the field.

Table V.54 presents the rebuttable-presumption payback periods for the considered TSLs for walk-in coolers and freezers. While DOE examined the rebuttable-presumption criterion, it considered whether the standard levels considered for the NOPR are economically justified through a more detailed analysis of the economic impacts of those levels, pursuant to 42 U.S.C. 6295(o)(2)(B)(i), that considers the full range of impacts to the consumer, manufacturer, Nation, and environment. The results of that analysis serve as the basis for DOE to definitively evaluate the economic justification for a potential standard level, thereby supporting or rebutting the results of any preliminary determination of economic justification.

TABLE V.54—REBUTTABLE-PRESUMPTION PAYBACK PERIODS FOR WALK-IN DOORS

Equipment class	Trial standard level		
	1	2	3
DW.L	....	....	65.7
DW.M	....	....	109.1
NM.L	1.6	1.6	3.3
NM.M	2.6	3.7	9.1
NO.L	1.2	1.2	2.6
NO.M	2.0	2.8	7.0

TABLE V.55—REBUTTABLE-PRESUMPTION PAYBACK PERIODS FOR WALK-IN PANELS

Equipment class	Trial standard level		
	1	2	3
PF.L	....	....	0.7
PS.L	....	....	0.6
PS.M	....	....	2.2

TABLE V.56—REBUTTABLE-PRESUMPTION PAYBACK PERIODS FOR REFRIGERATION SYSTEMS

Equipment class	TSL		
	1	2	3
DC.L.I	* Inf	inf	inf
DC.L.O	1.5	6.1	inf
DC.M.I	inf	inf	inf
DC.M.O	1.5	3.4	inf
SP.H.I	15.0	15.0	18.8
SP.H.ID	4.2	4.2	4.2
SP.H.O	0.3	3.5	12.2
SP.H.OD	0.2	3.5	3.9
SP.L.I	12.7	12.7	inf
SP.L.O	....	....	inf
SP.M.I	6.1	10.9	inf
SP.M.O	1.0	1.4	inf
UC.H	....	....	inf
UC.H.ID	0.8	0.8	0.8
UC.L	0.8	1.1	1.1

TABLE V.56—REBUTTABLE-PRESUMPTION PAYBACK PERIODS FOR REFRIGERATION SYSTEMS—Continued

Equipment class	TSL		
	1	2	3
UC.M	2.4	2.5	2.5

* Indicates that the estimated payback results are negative. This is the results of projected negative operating cost savings at the proposed TSL, resulting in overall negative payback periods.

2. Economic Impacts on Manufacturers

DOE performed an MIA to estimate the impact of amended energy conservation standards on manufacturers of walk-ins. The following section describes the expected impacts on manufacturers at each considered TSL. Chapter 12 of the NOPR TSD explains the analysis in further detail.

a. Industry Cash Flow Analysis Results

In this section, DOE provides GRIM results from the analysis, which examines changes in the industry that would result from a standard. The following tables summarize the estimated financial impacts (represented by changes in INPV) of potential amended energy conservation standards on manufacturers of walk-ins, as well as the conversion costs that DOE estimates manufacturers of walk-ins would incur at each TSL.

The impact of potential amended energy conservation standards were analyzed under two scenarios: (1) the preservation of gross margin percentage; and (2) the preservation of operating profit, as discussed in section IV.J.2.d of this document. The preservation of gross margin percentages applies a ''gross margin percentage'' of 31 percent for display doors, 33 percent for non-display doors, 24 percent for panels, and 26 percent for refrigeration systems, across all efficiency levels.[82] This scenario assumes that a manufacturer's per-unit dollar profit would increase as MPCs increase in the standards cases and often represents the upper-bound to industry profitability under potential amended energy conservation standards.

The preservation of operating profit scenario reflects manufacturers' concerns about their inability to maintain margins as MPCs increase to reach more-stringent efficiency levels. In this scenario, while manufacturers make the necessary investments required to convert their facilities to produce compliant equipment, operating profit does not change in absolute dollars and decreases as a percentage of revenue. The preservation of operating profit scenario typically results in the lower (or more severe) bound to impacts of potential amended standards on industry.

Each of the modeled scenarios results in a unique set of cash flows and corresponding INPV for each TSL. INPV is the sum of the discounted cash flows to the industry from the base year through the end of the analysis period (2023–2056). The ''change in INPV'' results refer to the difference in industry value between the no-new-standards case and standards case at each TSL. To provide perspective on the short-run cash flow impact, DOE includes a comparison of free cash flow between the no-new-standards case and the standards case at each TSL in the year before amended standards would take effect. This figure provides an understanding of the magnitude of the required conversion costs relative to the cash flow generated by the industry in the no-new-standards case.

Conversion costs are one-time investments for manufacturers to bring their manufacturing facilities and product designs into compliance with potential amended standards. As described in section IV.J.2.c of this document, conversion cost investments occur between the year of publication of the final rule and the year by which manufacturers must comply with the new standard. The conversion costs can have a significant impact on the short-term cash flow on the industry and generally result in lower free cash flow in the period between the publication of the final rule and the compliance date of potential amended standards. Conversion costs are independent of the manufacturer markup scenarios and are not presented as a range in this analysis.

Table V.57, Table V.58, Table V.59, and Table V.60 show the MIA results for each TSL for walk-in display door, non-display door, panel, and refrigeration system industries, respectively.

Doors

Display Doors

TABLE V.57—MANUFACTURER IMPACT ANALYSIS RESULTS FOR WALK-IN DISPLAY DOORS

	Unit	No-new-standards case	TSL 1	TSL 2	TSL 3
INPV	*2022$ Million*	278.0	278.0	278.0	215.5 to 355.6.
Change in INPV*	*%*				(22.5) to 27.9.
Free Cash Flow* (2026)	*2022$ Million*	21.7	21.7	21.7	12.8.
Change in Free Cash Flow* (2026)	*%*				(41.0).
Product Conversion Costs	*2022$ Million*				24.0
Capital Conversion Costs	*2022$ Million*				1.5.
Total Conversion Costs	*2022$ Million*				25.5.

* Parentheses (−) negative values.

At TSL 1 and TSL 2, the standard for all walk-in display door equipment classes (DW.L, DW.M) are set to the baseline efficiency level (EL 0). As a result, there are no changes to INPV, no changes in industry free cash flow, and no conversion costs.

[82] The gross margin percentages of 31 percent, 33 percent, 24 percent, and 26 percent are based on manufacturer markups of 1.45, 1.50, 1.32, and 1.35, respectively.

At TSL 3, the standard represents the max-tech energy efficiency for all equipment classes. The change in INPV is expected to range from −22.5 to 27.9 percent. At this level, free cash flow is estimated to decrease by 41.0 percent compared to the no-new-standards case value of $21.7 million in the year 2026, the year before the standards year. DOE estimates that no display door shipments currently meet the max-tech efficiency levels.

DOE expects display doors would require the use of vacuum-insulated glass as a substitute for the prescriptive minimum design of double-pane or triple-pane insulated glass packs for medium-temperature doors (DW.M) and low-temperature doors (DW.L), respectively. For the 10 OEMs that manufacture walk-in display doors, implementing vacuum-insulated glass would require significant engineering resources and testing time to ensure adequate durability of their doors in all commercial settings. In interviews, manufacturers emphasized that there are currently a very limited number of suppliers of vacuum-insulated glass. Door manufacturers expressed concerns that the 3-year conversion period between the publication of the final rule and the compliance date of the amended energy conservation standard might be insufficient to design and test a full portfolio of vacuum-insulated doors that meet the max-tech efficiencies and maintain their internal metrics over the door lifetime. Of the 10 OEMs that manufacture walk-in display doors, four are small, domestic businesses. DOE estimates capital conversion costs of $1.5 million and product conversion costs of $24.0 million. Conversion costs total $25.5 million.

At TSL 3, the shipment-weighted average MPC for all display doors is expected to increase by 63.6 percent relative to the no-new-standards case shipment-weighted average MPC for all display doors in 2027. In the preservation of gross margin percentage scenario, the increase in cashflow from the higher MSP outweighs the $25.5 million in conversion costs, causing a positive change in INPV at TSL 3 under this scenario. Under the preservation of operating profit scenario, manufacturers earn the same per-unit operating profit as would be earned in the no-new-standards case, but manufacturers do not earn additional profit from their investments. In this scenario, the manufacturer markup decreases in 2028, the year after the analyzed compliance year. This reduction in the manufacturer markup and the $25.5 million in conversion costs incurred by manufacturers cause a large negative change in INPV at TSL 3 under the preservation of operating profit scenario. See section IV.J.2.d of this document or chapter 12 of the NOPR TSD for additional details about the manufacturer markup scenarios.

Non-Display Doors

TABLE V.58—MANUFACTURER IMPACT ANALYSIS RESULTS FOR WALK-IN NON-DISPLAY DOORS

	Unit	No-new-standards case	TSL 1	TSL 2	TSL 3
INPV	*2022$ Million*	536.7	522.6 to 529.4	511.2 to 522.5	485.1 to 549.4.
Change in INPV*	%		(2.6) to (1.4)	(4.8) to (2.6)	(9.6) to 2.4.
Free Cash Flow* (2026)	*2022$ Million*	42.6	35.7	30.0	22.5.
Change in Free Cash Flow* (2026)	%		(16.1)	(29.5)	(47.1)
Product Conversion Costs	*2022$ Million*		2.4	3.8	15.8.
Capital Conversion Costs	*2022$ Million*		13.4	25.0	32.5.
Total Conversion Costs	*2022$ Million*		15.8	28.9	48.3.

* Parentheses (−) negative values.

At TSL 1, the standard represents a combination of efficiency levels where NPV at a 7-percent discount rate is maximized.[83] The change in INPV is expected to range from −2.6 to −1.4 percent. At this level, free cash flow is estimated to decrease by 16.1 percent compared to the no-new-standards case value of $42.6 million in the year 2026, the year before the standards year.

DOE expects that all non-display door equipment classes (NM.L, NM.M, NO.L, NO.M) would require anti-sweat heater controls. For low-temperature classes (NM.L, NO.L), DOE expects that manufacturers would also need to incorporate improved framing systems and reduced anti-sweat heat. For non-display door medium temperature classes (NM.M, NO.M), TSL 1 corresponds to EL 1. For non-display door low-temperature classes (NM.L, NO.L), TSL 1 corresponds to EL 3. Currently, approximately 61 percent of non-display door shipments meet the TSL 1 efficiencies. Capital conversion costs may be necessary to purchase additional foaming equipment to incorporate improved frame designs for low-temperature non-display doors, which account for approximately 32 percent of non-display door shipments. Product conversion costs may be necessary to update and test new non-display door designs. DOE estimates capital conversion costs of $13.4 million and product conversion costs of $2.4 million. Conversion costs total $15.8 million.

At TSL 1, the shipment-weighted average MPC for non-display doors is expected to increase by 1.6 percent relative to the no-new-standards case shipment-weighted average MPC for non-display doors in 2027. In the preservation of gross margin percentage scenario, the minor increase in cashflow from the higher MSP is slightly outweighed by the $15.8 million in conversion costs, causing a slightly negative change in INPV at TSL 1 under this scenario. Under the preservation of operating profit scenario, manufacturers earn the same per-unit operating profit as would be earned in the no-new-standards case, but manufacturers do not earn additional profit from their investments. In this scenario, the manufacturer markup decreases in 2028, the year after the analyzed compliance year. This reduction in the manufacturer markup and the $15.8 million in conversion costs incurred by manufacturers cause a slightly negative change in INPV at TSL 1 under the preservation of operating profit scenario.

At TSL 2, the standard represents a combination of efficiency levels for all

[83] As discussed in section IV.E.1 of this document, the TSL construction has an additional constraint that improvements to insulation are harmonized across non-display doors and structural panels to avoid a circumstance where DOE would propose a standard where one component would require increased insulation thickness, but not the other. Aligning the insulation thickness of non-display doors and panels avoids a potential unintended consequence where the installation of replacement non-display doors would trigger the replacement of some, or all, of the attached WICF enclosure (panels) because the thickness of the components do not match.

representative units where FFC is maximized while constrained to a positive NPV at a 7-percent discount rate.[84] The change in INPV is expected to range from −4.8 to −2.6 percent. At this level, free cash flow is estimated to decrease by 29.5 percent compared to the no-new-standards case value of $42.6 million in the year 2026, the year before the standards year.

At TSL 2, DOE expects that all non-display doors (NM.L, NM.M, NO.L, NO.M) would require anti-sweat heater controls, improved framing systems and reduced anti-sweat heat. For non-display door equipment classes, TSL 2 corresponds to EL 3. Currently, approximately 12 percent of non-display door shipments meet TSL 2 efficiencies. Capital conversion costs may be necessary to purchase additional foaming equipment to incorporate improved frame designs for all non-display doors. Product conversion costs may be necessary to update and test new non-display door designs. DOE estimates capital conversion costs of $25.0 million and product conversion costs of $3.8 million. Conversion costs total $28.9 million.

At TSL 2, the shipment-weighted average MPC for non-display doors is expected to increase by 2.8 percent relative to the no-new-standards case shipment-weighted average MPC for non-display doors in 2027. In the preservation of gross margin percentage scenario, the minor increase in cashflow from the higher MSP is slightly outweighed by the $28.9 million in conversion costs, causing a slightly negative change in INPV at TSL 2 under this scenario. Under the preservation of operating profit scenario, manufacturers earn the same per-unit operating profit as would be earned in the no-new-standards case, but manufacturers do not earn additional profit from their investments. In this scenario, the manufacturer markup decreases in 2028, the year after the analyzed compliance year. This reduction in the manufacturer markup and the $28.9 million in conversion costs incurred by manufacturers cause a slightly negative change in INPV at TSL 2 under the preservation of operating profit scenario.

At TSL 3, the standard represents the max-tech efficiency levels for all equipment classes. The change in INPV is expected to range from −9.6 to 2.4 percent. At this level, free cash flow is estimated to decrease by 47.1 percent compared to the no-new-standards case value of $42.6 million in the year 2026, the year before the standards year.

The design options DOE analyzed at TSL 3 for non-display doors included anti-sweat heater controls, improved framing systems, reduced anti-sweat heat, and insulation thickness of at least 6 inches. DOE estimates that no non-display door shipments currently meet the max-tech efficiency levels. For the 43 OEMs that manufacture walk-in non-display doors, increasing insulation thickness from the assumed baseline thickness of 3.5 inches for medium-temperature (NM.M, NO.M) and 4 inches for low-temperature (NM.L, NO.L) non-display doors to 6 inches would require purchasing new foaming equipment since most manufacturers are only able to manufacture non-display doors up to 5 inches thick. Additionally, non-display door manufacturers were concerned about the flow of foam and the curing time of foam at max-tech. New foaming equipment to accommodate 6-inch non-display doors would require significant capital investment and is a key driver of capital conversion costs. Of the 43 non-display door OEMs identified, 40 are small, domestic businesses. DOE estimates capital conversion costs of $32.5 million and product conversion costs of $15.8 million. Conversion costs total $48.3 million.

At TSL 3, the shipment-weighted average MPC for all non-display doors is expected to increase by 15.8 percent relative to the no-new-standards case shipment-weighted average MPC for non-display doors in 2027. In the preservation of gross margin percentage scenario, the increase in cashflow from the higher MSP slightly outweighs the $48.3 million in conversion costs, causing a positive change in INPV at TSL 3 under this scenario. Under the preservation of operating profit scenario, manufacturers earn the same per-unit operating profit as would be earned in the no-new-standards case, but manufacturers do not earn additional profit from their investments. In this scenario, the manufacturer markup decreases in 2028, the year after the analyzed compliance year. This reduction in the manufacturer markup and the $48.3 million in conversion costs incurred by manufacturers cause a negative change in INPV at TSL 3 under the preservation of operating profit scenario.

DOE seeks comments, information, and data on the capital conversion costs and product conversion costs estimated for each efficiency level and TSL for walk-in display and non-display doors. *See* chapter 12 of the NOPR TSD for the estimated conversion costs for each analyzed efficiency level.

Panels

TABLE V.59—MANUFACTURER IMPACT ANALYSIS RESULTS FOR WALK-IN PANELS

	Unit	No-new-standards case	TSL 1	TSL 2	TSL 3
INPV	*2022$ Million*	875.2	875.2	875.2	676.5 to 787.4.
Change in INPV*	*%*				(22.7) to (10.0).
Free Cash Flow* (2026)	*2022$ Million*	78.6	78.6	78.6	(22.0).
Change in Free* Cash Flow* (2026)	*%*				(128.0).
Product Conversion Costs	*2022$ Million*				74.5.
Capital Conversion Costs	*2022$ Million*				166.8.
Total Conversion Costs	*2022$ Million*				241.3.

* Parentheses (−) negative values.

At TSL 1 and TSL 2, the standard for all walk-in panel equipment classes are set to the baseline efficiency level (EL 0). As a result, there are no changes to INPV, no changes in industry free cash flow, and no conversion costs.

At TSL 3, the standard represents the max-tech energy efficiency for all equipment classes. The change in INPV is expected to range from −22.7 to −10.0 percent. At this level, free cash flow is estimated to decrease by 128.0

[84] As with TSL 1, DOE applied the additional constraint that improvements to insulation are harmonized across non-display doors and panels to avoid a circumstance where DOE would propose a standard where one component would require increased insulation thickness, but not the other.

percent compared to the no-new-standards case value of $78.6 million in the year 2026, the year before the standards year. Currently, approximately 3 percent of domestic panel shipments meet the efficiencies required at TSL 3.

The design options DOE analyzed at max-tech include increasing insulation thickness to 6 inches across all equipment classes. At this level, DOE assumes all manufacturers will need to purchase new foaming equipment. Increasing the insulation thickness for all panel equipment classes to 6 inches would require significant capital investment. Like non-display doors, most manufacturers are currently able to manufacture panels up to 5 inches thick. A standard level necessitating 6-inch panels would likely require new, costly foaming equipment for all manufacturers. Additionally, DOE estimates that every additional inch of foam increases panel cure times by roughly 10 minutes, which means that manufacturers would likely need to purchase additional equipment to maintain existing throughput. Some OEMs may need to invest in additional manufacturing space to accommodate the extra foaming stations. Of the 42 walk-in panel OEMs, 38 OEMs are small, domestic businesses. In interviews, manufacturers expressed concern about industry's ability to source the necessary foaming equipment to maintain existing production capacity within the 3-year compliance period due to the long lead times and limited number of foam fixture suppliers. DOE estimates capital conversion costs of $166.8 million and product conversion costs of $74.5 million. Conversion costs total $241.3 million.

At TSL 3, the large conversion costs result in a free cash flow dropping below zero in the years before the standards year. The negative free cash flow calculation indicates manufacturers may need to access cash reserves or outside capital to finance conversion efforts.

At TSL 3, the shipment-weighted average MPC for all panels is expected to increase by 17.4 percent relative to the no-new-standards case shipment-weighted average MPC for all panels in 2027. In the preservation of gross margin percentage scenario, the increase in cashflow from the higher MSP is outweighed by the $241.3 million in conversion costs, causing a negative change in INPV at TSL 3 under this scenario. Under the preservation of operating profit scenario, manufacturers earn the same per-unit operating profit as would be earned in the no-new-standards case, but manufacturers do not earn additional profit from their investments. In this scenario, the manufacturer markup decreases in 2028, the year after the analyzed compliance year. This reduction in the manufacturer markup and the $241.3 million in conversion costs incurred by manufacturers cause a large negative change in INPV at TSL 3 under the preservation of operating profit scenario.

DOE seeks comments, information, and data on the capital conversion costs and product conversion costs estimated for each efficiency level and TSL for walk-in panels. *See* chapter 12 of the NOPR TSD for the estimated conversion costs for each analyzed efficiency level.

Refrigeration Systems

TABLE V.60—MANUFACTURER IMPACT ANALYSIS RESULTS FOR WALK-IN REFRIGERATION SYSTEMS

	Unit	No-new-standards case	TSL 1	TSL 2	TSL 3
INPV	*2022$ Million*	490.1	447.2 to 453.0	442.2 to 452.2	330.5 to 456.2.
Change in INPV *	*%*		(8.7) to (7.6)	(9.8) to (7.7)	(32.6) to 11.5.
Free Cash Flow (2026)	*2022$ Million*	44.8	21.7	20.7	7.3.
Change in Free Cash Flow (2026) *	*%*		(51.6)	(53.7)	(83.7).
Product Conversion Costs	*2022$ Million*		25.3	28.0	47.1.
Capital Conversion Costs	*2022$ Million*		32.1	32.1	47.5.
Total Conversion Costs	*2022$ Million*		57.4	60.1	94.6.

* Parentheses (−) negative values.

At TSL 1, the standard represents a combination of efficiency levels where NPV at a 7-percent discount rate is maximized. The change in INPV is expected to range from −8.7 to −7.6 percent. At this level, free cash flow is estimated to decrease by 51.6 percent compared to the no-new-standards case value of $44.8 million in the year 2026, the year before the standards year. Currently, DOE has no evidence of significant shipments meeting efficiency levels above the baseline efficiency level (EL 0).

DOE expects that at TSL 1, low- and medium-temperature indoor dedicated condensing system equipment classes [85] would generally require larger condenser coils; low- and medium-temperature outdoor dedicated condensing system equipment classes would generally require self-regulating crank case heater controls with a temperature switch; low-temperature outdoor dedicated condensing systems would also generally require electronically commutated variable-speed condenser fan motors; some low- and medium-temperature single-packaged dedicated system equipment classes would require variable-speed evaporator fans; lower-capacity low- and medium-temperature single-packaged dedicated condensing units would generally require propane compressors; high-temperature outdoor single-packaged dedicated condensing systems would generally require self-regulating crank case heater controls with a temperature switch and variable-speed condenser fans; high-temperature indoor single-packaged dedicated condensing systems would generally require up to 1.5 inches of thermal insulation. DOE expects that at TSL 1, most unit cooler equipment classes would incorporate improved evaporator coil designs. See Table IV.28 for the efficiency levels by representative unit for TSL 1.

Capital conversion costs are driven by incorporating design options such as larger condenser coils, improved evaporator coils, and/or ambient subcooling circuits, which would likely necessitate new tooling for updated baseplate designs across some refrigeration system capacities and equipment classes. Implementing these design options would also require notable engineering resources and testing time, as manufacturers redesign models. Manufacturers would also need to qualify, source, and test new high-

[85] Dedicated condensing system equipment classes include dedicated condensing units, matched-pair refrigeration systems (consisting of a paired dedicated condensing unit and unit cooler) and single-packaged dedicated systems.

efficiency components. DOE estimates capital conversion costs of $32.1 million and product conversion costs of $25.3 million. Conversion costs total $57.4 million.

At TSL 1, the shipment-weighted average MPC for all refrigeration systems is expected to increase by 1.5 percent relative to the no-new-standards case shipment-weighted average MPC for all refrigeration systems in 2027. In the preservation of gross margin percentage scenario, the minor increase in cashflow from the higher MSP is slightly outweighed by the $57.4 million in conversion costs, causing a slightly negative change in INPV at TSL 1 under this scenario. Under the preservation of operating profit scenario, manufacturers earn the same per-unit operating profit as would be earned in the no-new-standards case, but manufacturers do not earn additional profit from their investments. In this scenario, the manufacturer markup decreases in 2028, the year after the analyzed compliance year. This reduction in the manufacturer markup and the $57.4 million in conversion costs incurred by manufacturers cause a slightly negative change in INPV at TSL 1 under the preservation of operating profit scenario.

At TSL 2, the standard represents a combination efficiency levels where FFC is maximized while constrained to a positive NPV at a 7-percent discount rate. The change in INPV is expected to range from −9.8 to −7.7 percent. At this level, free cash flow is estimated to decrease by 53.7 percent compared to the no-new-standards case value of $44.8 million in the year 2026, the year before the standards year.

At TSL 2, DOE expects that manufacturers would need to incorporate similar design options as TSL 1. In addition to the design options analyzed at TSL 1, DOE expects that some low-temperature and indoor medium-temperature dedicated condensing system equipment classes would require larger condenser coils and/or ambient subcooling circuits. DOE expects that more medium-temperature outdoor dedicated condensing system equipment classes would require electronically commutated condenser fan motors and may require ambient subcooling circuits. DOE also expects that more low- and medium-temperature single-packaged dedicated system equipment classes would require larger evaporator coils and variable-speed evaporator fans. Low-temperature single-packaged dedicated system equipment classes would also generally require thermal insulation up to 4 inches in thickness (*i.e.,* SP.M.O.002, SP.M.I.002). High-temperature single-packaged dedicated condensing systems would generally require up to 1.5 inches of thermal insulation, electronically commutated variable-speed condenser fan motors, and ambient subcooling. DOE expects that at TSL 2, more unit cooler equipment classes would incorporate the max-tech design options (*i.e.,* all equipment classes except for high-temperature non-ducted unit coolers, which would generally require evaporator coils 4 rows deep at TSL 2). See Table IV.26 for the efficiency levels by representative unit for TSL 2.

DOE expects manufacturers would incur similar capital conversion costs at TSL 2 and TSL 1 since most manufacturers could rely on similar tooling investments at both TSLs. DOE expects manufacturers would incur slightly more conversion costs compared to TSL 1 as they update and test more refrigeration system capacities across their portfolio. DOE estimates capital conversion costs of $32.1 million and product conversion costs of $28.0 million. Conversion costs total $60.1 million.

At TSL 2, the shipment-weighted average MPC for all refrigeration systems is expected to increase by 2.6 percent relative to the no-new-standards case shipment-weighted average MPC for all refrigeration systems in 2027. In the preservation of gross margin percentage scenario, the increase in cashflow from the higher MSP is slightly outweighed by the $60.1 million in conversion costs, causing a slightly negative change in INPV at TSL 2 under this scenario. Under the preservation of operating profit scenario, manufacturers earn the same per-unit operating profit as would be earned in the no-new-standards case, but manufacturers do not earn additional profit from their investments. In this scenario, the manufacturer markup decreases in 2028, the year after the analyzed compliance year. This reduction in the manufacturer markup and the $60.1 million in conversion costs incurred by manufacturers cause a negative change in INPV at TSL 2 under the preservation of operating profit scenario.

At TSL 3, the standard represents the max-tech efficiency for all equipment classes. The change in INPV is expected to range from −32.6 to 11.5 percent. At this level, free cash flow is estimated to decrease by 83.7 percent compared to the no-new-standards case value of $44.8 million in the year 2026, the year before the standards year.

At TSL 3, all manufacturers would need to incorporate all analyzed design options to meet the efficiencies required. DOE expects that medium- and low-temperature dedicated condensing system equipment classes would require larger condenser coils, variable capacity compressors, and electronically commutated variable-speed condenser fan motors. Additionally, low- and medium-temperature outdoor dedicated condensing system equipment classes would generally require self-regulating crank case heater controls with a temperature switch, and ambient subcooling circuits. DOE anticipates that low- and medium-temperature single-packaged dedicated system equipment classes would also require larger evaporator coils, variable speed evaporator fans, and thermal insulation up to 4 inches in thickness. DOE expects that lower-capacity low- and medium-temperature single-packaged dedicated condensing units would require propane compressors. DOE expects that high-temperature dedicated condensing system equipment classes would require the same design options as medium- and low-temperature dedicated condensing systems except for larger condensing coils and variable capacity compressors. Additionally, DOE expects that high-temperature single-packaged dedicated condensing systems would require up to 1.5 inches of thermal insulation and would not require larger evaporator coils or variable speed evaporator fans. DOE anticipates that lower-capacity low- and medium-temperature unit cooler equipment classes would require evaporator coils 4 rows deep at TSL 3. Finally, DOE anticipates that higher-capacity low- and medium-temperature unit cooler equipment classes and all high-temperature unit cooler equipment classes would require evaporator coils 5 rows deep at TSL 3. See Table IV.24 for the efficiency levels by representative unit for TSL 3.

Currently, DOE has no evidence of significant shipments meeting the max-tech levels. As such, DOE assumes that all manufacturers would need to redesign their refrigeration system models to incorporate a range of design options to meet TSL 3 efficiencies. Capital conversion costs are driven by incorporating design options such as larger condenser coils, improved evaporator coils, and/or ambient subcooling circuits, which would likely necessitate new tooling for updated baseplate designs across the full range of refrigeration system capacities and equipment classes. Implementing these design options would also require notable engineering resources and testing time, as manufacturers redesign models and potentially increase the footprint of refrigeration systems to accommodate larger condensers and/or evaporators.

Manufacturers would also need to qualify, source, and test new high-efficiency components. For medium- and low-temperature dedicated condensing system equipment classes that would likely require variable capacity compressors to meet the max-tech levels, manufacturers could face challenges sourcing variable capacity compressors across their portfolio of capacity offerings since the availability of variable capacity compressors for walk-in applications is limited. At the time of this NOPR publication, the few variable capacity compressor product lines DOE identified are not advertised for the North American market. Additionally, the identified product lines may not have a sufficient range of available compressor capacities to replace compressors in all walk-in applications. DOE estimates capital conversion costs of $47.5 million and product conversion costs of $47.1 million. Conversion costs total $94.6 million.

At TSL 3, the shipment-weighted average MPC for all refrigeration systems is expected to increase by 55.5 percent relative to the no-new-standards case shipment-weighted average MPC for all refrigeration systems in 2027. In the preservation of gross margin percentage scenario, the increase in cashflow from the higher MSP outweighs the $94.6 million in conversion costs, causing a positive change in INPV at TSL 3 under this scenario. Under the preservation of operating profit scenario, manufacturers earn the same per-unit operating profit as would be earned in the no-new-standards case, but manufacturers do not earn additional profit from their investments. In this scenario, the manufacturer markup decreases in 2028, the year after the analyzed compliance year. This reduction in the manufacturer markup and the $94.6 million in conversion costs incurred by manufacturers cause a significant negative change in INPV at TSL 3 under the preservation of operating profit scenario.

DOE seeks comments, information, and data on the capital conversion costs and product conversion costs estimated for each TSL for walk-in refrigeration systems.

b. Direct Impacts on Employment

To quantitatively assess the potential impacts of amended energy conservation standards on direct employment in the walk-in industry, DOE used the GRIM to estimate the domestic labor expenditures and number of direct employees in the no-new-standards case and in each of the standards cases during the analysis period. DOE calculated these values using statistical data from the 2021 *ASM*,[86] BLS employee compensation data,[87] results of the engineering analysis, and manufacturer interviews.

Labor expenditures related to product manufacturing depend on the labor intensity of the product, the sales volume, and an assumption that wages remain fixed in real terms over time. The total labor expenditures in each year are calculated by multiplying the total MPCs by the labor percentage of MPCs. The total labor expenditures in the GRIM were then converted to total production employment levels by dividing production labor expenditures by the average fully burdened wage multiplied by the average number of hours worked per year per production worker. To do this, DOE relied on the *ASM* inputs: Production Workers Annual Wages, Production Workers Annual Hours, Production Workers for Pay Period, and Number of Employees. DOE also relied on the BLS employee compensation data to determine the fully burdened wage ratio. The fully burdened wage ratio factors in paid leave, supplemental pay, insurance, retirement and savings, and legally required benefits.

The number of production employees is then multiplied by the U.S. labor percentage to convert total production employment to total domestic production employment. The U.S. labor percentage represents the industry fraction of domestic manufacturing production capacity for the covered equipment. This value is derived from manufacturer interviews, equipment database analysis, and publicly available information. DOE estimates that approximately 90 percent of doors, 95 percent of panels, and 70 percent of refrigeration systems are manufactured domestically.

The domestic production employees estimate covers production line workers, including line supervisors, who are directly involved in fabricating and assembling products within the OEM facility. Workers performing services that are closely associated with production operations, such as materials handling tasks using forklifts, are also included as production labor. DOE's estimates only account for production workers who manufacture the specific equipment covered by this proposed rulemaking.

Non-production workers account for the remainder of the direct employment figure. The non-production employees estimate covers domestic workers who are not directly involved in the production process, such as sales, engineering, human resources, and management. Using the amount of domestic production workers calculated above, non-production domestic employees are extrapolated by multiplying the ratio of non-production workers in the industry compared to production employees. DOE assumes that this employee distribution ratio remains constant between the no-new-standards case and standards cases.

In evaluating the impact of energy efficiency standards on employment, DOE performed separate analyses on all three walk-in component manufacturer industries: doors, panels, and refrigeration systems.

Using the GRIM, DOE estimates in the absence of amended energy conservation standards there would be 4,351 domestic workers for walk-in doors, 7,534 domestic workers for walk-in panels, and 877 domestic workers for walk-in refrigeration systems in 2027. Table V.61, Table V.62, and Table V.63 show the range of the impacts of potential amended energy conservation standards on U.S. manufacturing employment in the door, panel, and refrigeration systems markets, respectively.

[86] U.S. Census Bureau, *Annual Survey of Manufactures.* ''Summary Statistics for Industry Groups and Industries in the U.S. (2021).'' Available at: *www.census.gov/data/tables/time-series/econ/asm/2018-2021-asm.html* (Last accessed February 14, 2023).

[87] U.S. Bureau of Labor Statistics. *Employer Costs for Employee Compensation.* March 17, 2023. Available at: *www.bls.gov/news.release/pdf/ecec.pdf* (Last accessed April 12, 2023).

TABLE V.61—DIRECT EMPLOYMENT IMPACTS FOR DOMESTIC WALK-IN DOOR MANUFACTURERS IN 2027

	No-new-standards case	Trial standard levels		
		1	2	3
Direct Employment in 2027 (Production Workers + Non-Production Workers)	4,351	4,434	4,526	4,710
Potential Changes in Direct Employment in 2027 *		(3,193) to 83	(3,193) to 175	(3,193) to 359

* DOE presents a range of potential employment impacts. Numbers in parentheses denote negative values.

TABLE V.62—DIRECT EMPLOYMENT IMPACTS FOR DOMESTIC WALK-IN PANEL MANUFACTURERS IN 2027

	No-new-standards case	Trial standard levels		
		1	2	3
Direct Employment in 2027 (Production Workers + Non-Production Workers)	7,534	7,534	7,534	7,689
Potential Changes in Direct Employment in 2027 *				(5,529) to 155

* DOE presents a range of potential employment impacts. Numbers in parentheses denote negative values.

TABLE V.63—DIRECT EMPLOYMENT IMPACTS FOR DOMESTIC WALK-IN REFRIGERATION SYSTEM MANUFACTURERS IN 2027

	No-new-standards case	Trial standard levels		
		1	2	3
Direct Employment in 2027 (Production Workers + Non-Production Workers)	877	894	905	958
Potential Changes in Direct Employment in 2027 *		(644) to 17	(644) to 28	(644) to 81

* DOE presents a range of potential employment impacts. Numbers in parentheses denote negative values.

The direct employment impacts shown in Table V.61 through Table V.63 represent the potential domestic employment changes that could result following the compliance date of amended energy conservation standards. The upper bound estimate corresponds to the change in the number of domestic workers that would result from amended energy conservation standards if manufacturers continue to produce the same scope of covered equipment within the United States after compliance takes effect. To establish a conservative lower bound, DOE assumes all manufacturers would shift production to foreign countries with lower costs of labor.

Additional detail on the analysis of direct employment can be found in chapter 12 of the NOPR TSD. Additionally, the employment impacts discussed in this section are independent of the employment impacts from the broader U.S. economy, which are documented in chapter 16 of the NOPR TSD.

c. Impacts on Manufacturing Capacity

Doors

Display Doors

In interviews, display door manufacturers indicated that implementing vacuum-insulated glass across all equipment classes and configurations would require significant engineering resources and testing time to ensure adequate durability in all commercial settings. Manufacturers also emphasized that there are currently a very limited number of suppliers of vacuum-insulated glass. In interviews, manufacturers expressed concerns that the 3-year time period between the announcement of the final rule and the compliance date of the amended energy conservation standard might be insufficient to design and test a full portfolio of new doors.

Non-Display Doors

The production of non-display doors is very similar to the production of panels and faces the same capacity challenges as panels, which is discussed in the following paragraphs. As indicated in the panel discussion, DOE does not anticipate capacity constraints at a standard that moves manufacturers to 5 inches of thickness.

DOE seeks comment on whether manufacturers expect manufacturing capacity constraints would limit walk-in display and non-display door availability to consumers in the timeframe of the amended standard compliance date (2027).

Panels

Manufacturers indicated that design options that necessitate thicker panels could lead to longer production times for panels. In general, every additional inch of foam increases cure times by roughly 10 minutes. Based on information from manufacturer interviews and the engineering analysis, DOE understands that a number of manufacturers are able to produce panels above the baseline today and that a standard based on 5-inch panels is not likely to lead to equipment shortages in the industry. However, a standard that necessitates 6-inch panels for any of the panel equipment class would require manufacturers to add foaming equipment to maintain throughput due to longer curing times or to purchase all new tooling to enable production if the manufacturer's current equipment cannot accommodate 6-inch panels.

DOE seeks comment on whether manufacturers expect manufacturing capacity constraints would limit walk-in panel availability to consumers in the timeframe of the amended standard compliance date (2027).

Refrigeration Systems

Manufacturers raised concerns about technical resource constraints due to overlapping regulations. Manufacturers may face resource constraints should EPA finalize its proposals in the December 2022 AIM NOPR and DOE set more stringent standards that necessitate the redesign of the majority of models. These manufacturers stated that meeting EPA's proposed refrigerant regulation would take significant amounts of engineering resources, laboratory time, and investment.

Based on manufacturer feedback from confidential interviews and publicly available information, DOE expects the walk-in refrigeration system industry would need to invest approximately $29.5 million over a two-year time period (2023–2024) to redesign models for low-GWP refrigerants and retrofit manufacturing facilities to accommodate flammable refrigerants in order to comply with EPA's proposal. Should amended standards require significant product development or capital investment, the 3-year period between the announcement of the final rule and the compliance date of the amended energy conservation standard might be insufficient to complete the dual development needed to meet both EPA and DOE regulations.

DOE seeks comment on whether manufacturers expect manufacturing capacity constraints or engineering resource constraints would limit walk-in refrigeration system availability to consumers in the timeframe of the amended standard compliance date (2027).

d. Impacts on Subgroups of Manufacturers

Using average cost assumptions to develop industry cash flow estimates may not capture the differential impacts among subgroups of manufacturers. Small manufacturers, niche players, or manufacturers exhibiting a cost structure that differs substantially from the industry average could be affected disproportionately. DOE investigated small businesses as a manufacturer subgroup that could be disproportionally impacted by energy conservation standards and could merit additional analysis. DOE did not identify any other adversely impacted manufacturer subgroups for this rulemaking based on the results of the industry characterization.

DOE analyzes the impacts on small businesses in a separate analysis in section VI.B of this document as part of the Regulatory Flexibility Analysis. In summary, the Small Business Administration (''SBA'') defines a ''small business'' as having 1,250 employees or less for NAICS 333415, ''Air Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.'' For a discussion of the impacts on the small business manufacturer subgroup, see the Regulatory Flexibility Analysis in section VI.B of this document and chapter 12 of the NOPR TSD.

e. Cumulative Regulatory Burden

One aspect of assessing manufacturer burden involves looking at the cumulative impact of multiple DOE standards and the product/equipment-specific regulatory actions of other Federal agencies that affect the manufacturers of a covered product or equipment. While any one regulation may not impose a significant burden on manufacturers, the combined effects of several existing or impending regulations may have serious consequences for some manufacturers, groups of manufacturers, or an entire industry. Assessing the impact of a single regulation may overlook this cumulative regulatory burden. In addition to energy conservation standards, other regulations can significantly affect manufacturers' financial operations. Multiple regulations affecting the same manufacturer can strain profits and lead companies to abandon product lines or markets with lower expected future returns than competing products. For these reasons, DOE conducts an analysis of cumulative regulatory burden as part of its rulemakings pertaining to appliance efficiency.

TABLE V.64—COMPLIANCE DATES AND EXPECTED CONVERSION EXPENSES OF FEDERAL ENERGY CONSERVATION STANDARDS AFFECTING WALK-IN OEMS

Federal energy conservation standard	Number of OEMs *	Number of OEMs affected by today's rule **	Approx. standards compliance year	Industry conversion costs (millions $)	Industry conversion costs/product revenue *** (%)
Consumer Pool Heaters, 88 FR 34624 (May 30, 2023)	20	1	2028	$48.4 (2021$)	1.5
Commercial Water Heating Equipment,† 87 FR 30610 (May 19, 2022)	14	1	2026	34.60 (2020$)	4.7
Consumer Furnaces,† 87 FR 40590 (July 7, 2022)	15	4	2029	150.6 (2020$)	1.4
Microwave Ovens, 88 FR 39912 (June 20, 2023)	18	2	2026	46.1 (2021$)	0.7
Consumer Conventional Cooking Products, 88 FR 6818† (February 1, 2023)	34	1	2027	183.4 (2021$)	1.2
Refrigerators, Freezers, and Refrigerator-Freezers,† 88 FR 12452 (February 27, 2023)	49	1	2027	1,323.6 (2021$)	3.8
Room Air Conditioners, 88 FR 34298 (May 26, 2023)	8	1	2026	24.8 (2021$)	0.4
Miscellaneous Refrigeration Products,† 88 FR 7840 (February 7, 2023)	38	2	2029	126.9 (2021$)	3.1
Dishwashers,† 88 FR 32514 (May 19, 2023)	22	1	2027	125.6 (2021$)	2.1
Consumer Water Heaters † ‡	22	1	2030	228.1 (2022$)	1.3
Automatic Commercial Ice Makers,† 88 FR 30508 (May 11, 2023)	23	2	2027	15.9 (2022$)	0.6
Consumer Boilers † ‡	24	1	2030	69.5 (2022$)	2.6

* This column presents the total number of OEMs identified in the energy conservation standard rule that is contributing to cumulative regulatory burden.

** This column presents the number of OEMs producing walk-ins that are also listed as OEMs in the identified energy conservation standard that is contributing to cumulative regulatory burden.

*** This column presents industry conversion costs as a percentage of product revenue during the conversion period. Industry conversion costs are the upfront investments manufacturers must make to sell compliant products/equipment. The revenue used for this calculation is the revenue from just the covered product/equipment associated with each row. The conversion period is the time frame over which conversion costs are made and lasts from the publication year of the final rule to the compliance year of the energy conservation standard. The conversion period typically ranges from 3 to 5 years, depending on the rulemaking.

† These rulemakings are at the NOPR stage, and all values are subject to change until finalized through publication of a final rule.

‡ At the time of issuance of this WICFs proposed rule, the consumer water heaters and consumer boilers proposed rules have been issued and are pending publication in the FEDERAL REGISTER. Once published, the proposed rule pertaining to consumer water heaters will be available at: *www.regulations.gov/docket/EERE-2017-BT-STD-001*9 and the proposed rule pertaining to consumer boilers will be available at: *www.regulations.gov/docket/EERE-2012-BT-STD-0047.*

Other Federal Regulations

The December 2022 AIM NOPR [88] proposes to restrict the use of hydrofluorocarbons in specific sectors or subsectors, including use in walk-in refrigeration systems. DOE understands that switching from non-flammable to flammable refrigerants requires time and investment to redesign walk-in refrigeration systems and upgrade production facilities to accommodate the additional structural and safety precautions required. As discussed in sections IV.C.1.d of this document, DOE tentatively expects manufacturers will need to transition to an A2L or A3 refrigerant or CO_2 to comply with upcoming refrigerant regulations, such as the December 2022 AIM NOPR, prior to the expected 2027 compliance date of any potential energy conservation standards. DOE tentatively determined that dedicating condensing systems would not suffer a performance penalty when switching to the likely low-GWP alternative (*i.e.,* R–454A), and, therefore, DOE has continued to use R–448A and R–449A as the baseline refrigerant for all medium- and low-temperature dedicated condensing units and single-packaged dedicated systems in this NOPR analysis. DOE also does not expect that unit coolers would suffer a performance penalty when switching to low-GWP alternatives since increased refrigerant glide does not decrease unit cooler performance. Therefore, DOE has continued to use R–404A for medium- and low-temperature unit coolers and R–134A for high-temperature unit coolers in this NOPR analysis.

Although DOE maintains the use of current refrigerants (*i.e.,* R–448A, R–449A, R–404A, and R–134A) in its engineering analysis due to its tentative conclusion that there will be performance parity with the likely low-GWP alternatives, DOE still considers the cost associated with the refrigerant transition in its GRIM because the change in refrigerant is independent of DOE actions related to any amended energy conservation standards. Investments required to transition to flammable refrigerants in response to EPA's proposed rule, should it be finalized, necessitates a level of investment beyond typical annual R&D and capital expenditures. DOE accounted for the costs associated with redesigning walk-in refrigeration systems to make use of flammable refrigerants and retrofitting production facilities to accommodate flammable refrigerants in the GRIM in the no-new-standards case and standards cases to reflect the cumulative regulatory burden from Federal refrigerant regulation. DOE relied on manufacturer feedback in confidential interviews. a report prepared for EPA,[89] and written comments from AHRI in response to the June 2022 Preliminary Analysis to estimate the industry refrigerant transition costs. Based on feedback, DOE assumed that the transition to low-GWP refrigerants would require industry to invest approximately $14.5 million in R&D and $15.0 million in capital expenditures (*e.g.,* investments in new charging equipment, leak detection systems, *etc.*).

DOE requests comments on the magnitude of costs associated with transitioning walk-in refrigeration systems and production facilities to accommodate low-GWP refrigerants that would be incurred between the publication of this NOPR and the proposed compliance date of amended standards. Quantification and categorization of these costs, such as engineering efforts, testing lab time, certification costs, and capital investments (*e.g.,* new charging equipment), would enable DOE to refine its analysis.

DOE requests information regarding the impact of cumulative regulatory burden on manufacturers of walk-ins associated with multiple DOE standards or product/equipment-specific regulatory actions of other Federal agencies.

3. National Impact Analysis

This section presents DOE's estimates of the NES and the NPV of consumer benefits that would result from each of the TSLs considered as potential amended standards.

a. Significance of Energy Savings

To estimate the energy savings attributable to potential amended standards for walk-in coolers and freezers, DOE compared their energy consumption under the no-new-standards case to their anticipated energy consumption under each TSL. The savings are measured over the entire lifetime of products purchased in the 30-year period that begins in the year of anticipated compliance with amended standards (2027–2056). Table V.65 through Table V.70 presents DOE's projections of the NES for each TSL considered for walk-in coolers and freezers. The savings were calculated using the approach described in section IV.H of this document.

TABLE V.65—CUMULATIVE NATIONAL ENERGY SAVINGS FOR WALK-IN COOLERS AND FREEZER DOORS; 30 YEARS OF SHIPMENTS 2027–2056

	Trial standard level		
	1	2	3
	(quads)		
Primary energy	0.53	0.62	0.89
FFC energy	0.54	0.64	0.92

[88] The proposed rule was published on December 15, 2022. 87 FR 76738.

[89] *See* pp. 5–113 of the ''Global Non-CO_2 Greenhouse Gas Emission Projections & Marginal Abatement Cost Analysis: Methodology Documentation'' (2019). Available at *www.epa.gov/sites/default/files/2019-09/documents/nonco2_methodology_report.pdf.*

TABLE V.66 CUMULATIVE NATIONAL ENERGY SAVINGS FOR WALK-IN COOLERS AND FREEZER PANELS; 30 YEARS OF SHIPMENTS 2027–2056

	Trial Standard Level		
	1	2	3
	(quads)		
Primary energy	0.00	0.00	0.63
FFC energy	0.00	0.00	0.64

TABLE V.67—CUMULATIVE NATIONAL ENERGY SAVINGS FOR WALK-IN COOLERS AND FREEZER REFRIGERATION SYSTEMS; 30 YEARS OF SHIPMENTS

[2027–2056]

	Trial standard level		
	1	2	3
	(quads)		
Primary energy	0.68	0.89	3.02
FFC energy	0.70	0.91	3.10

OMB Circular A–4 [90] requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs. Circular A–4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. For this rulemaking, DOE undertook a sensitivity analysis using 9 years, rather than 30 years, of product shipments. The choice of a 9-year period is a proxy for the timeline in EPCA for the review of certain energy conservation standards and potential revision of and compliance with such revised standards.[91] The review timeframe established in EPCA is generally not synchronized with the product lifetime, product manufacturing cycles, or other factors specific to walk-ins. Thus, such results are presented for informational purposes only and are not indicative of any change in DOE's analytical methodology. The NES sensitivity analysis results based on a 9-year analytical period are presented in Table V.70. The impacts are counted over the lifetime of walk-in components purchased in 2027–2035.

TABLE V.68—CUMULATIVE NATIONAL ENERGY SAVINGS FOR WALK-IN COOLERS AND FREEZERS DOORS; 9 YEARS OF SHIPMENTS

[2027–2035]

	Trial standard level		
	1	2	3
	(quads)		
Primary energy	0.14	0.16	0.24
FFC energy	0.14	0.17	0.24

TABLE V.69—CUMULATIVE NATIONAL ENERGY SAVINGS FOR WALK-IN COOLERS AND FREEZERS PANELS; 9 YEARS OF SHIPMENTS

[2027–2035]

	Trial standard level		
	1	2	3
	(quads)		
Primary energy	....	....	0.17
FFC energy	....	....	0.18

[90] U.S. Office of Management and Budget. Circular A–4: Regulatory Analysis. September 17, 2003. *www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/circulars/A4/a-4.pdf* (last accessed April 26, 2023).

[91] EPCA requires DOE to review its standards at least once every 6 years, and requires, for certain products, a 3-year period after any new standard is promulgated before compliance is required, except that in no case may any new standards be required within 6 years of the compliance date of the previous standards. (42 U.S.C. 6316(a); 42 U.S.C. 6295(m)) While adding a 6-year review to the 3-year compliance period adds up to 9 years, DOE notes that it may undertake reviews at any time within the 6 year period and that the 3-year compliance date may yield to the 6-year backstop. A 9-year analysis period may not be appropriate given the variability that occurs in the timing of standards reviews and the fact that for some products, the compliance period is 5 years rather than 3 years.

TABLE V.70—CUMULATIVE NATIONAL ENERGY SAVINGS FOR WALK-IN COOLERS AND FREEZERS REFRIGERATION SYSTEMS; 9 YEARS OF SHIPMENTS
[2027–2035]

	Trial standard level		
	1	2	3
	(quads)		
Primary energy	0.19	0.24	0.83
FFC energy	0.19	0.25	0.85

b. Net Present Value of Consumer Costs and Benefits

DOE estimated the cumulative NPV of the total costs and savings for consumers that would result from the TSLs considered for walk-in components. In accordance with OMB's guidelines on regulatory analysis,[92] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V.71 through Table V.73 shows the consumer NPV results with impacts counted over the lifetime of products purchased in 2027–2056.

TABLE V.71—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR WALK-IN COOLERS AND FREEZERS DOORS; 30 YEARS OF SHIPMENTS
[2027–2056]

Discount rate	Trial standard level		
	1	2	3
	(billion 2022$)		
3 percent	1.56	1.74	−7.96
7 percent	0.70	0.77	−4.65

TABLE V.72—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR WALK-IN COOLERS AND FREEZERS PANELS; 30 YEARS OF SHIPMENTS
[2027–2056]

Discount rate	Trial standard level		
	1	2	3
	(billion 2022$)		
3 percent	....	....	−5.18
7 percent	....	....	−3.10

TABLE V.73—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR WALK-IN COOLERS AND FREEZERS REFRIGERATION SYSTEMS; 30 YEARS OF SHIPMENTS
[2027–2056]

Discount rate	Trial standard level		
	1	2	3
	(billion 2022$)		
3 percent	1.49	1.62	−25.14
7 percent	0.64	0.68	−12.99

The NPV results based on the aforementioned 9-year analytical period are presented in Table V.74 through Table V.76. The impacts are counted over the lifetime of products purchased in 2027–2035. As mentioned previously, such results are presented for informational purposes only and are not indicative of any change in DOE's analytical methodology or decision criteria.

[92] U.S. Office of Management and Budget. Circular A–4: Regulatory Analysis. September 17, 2003. *www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/circulars/A4/a-4.pdf* (last accessed April 26, 2023).

TABLE V.74—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR WALK-IN COOLERS AND FREEZERS DOORS; 9 YEARS OF SHIPMENTS

[2027–2035]

Discount rate	Trial standard level		
	1	2	3
	(billion 2022$)		
3 percent	0.56	0.63	−2.86
7 percent	0.34	0.37	−2.27

TABLE V.75—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR WALK-IN COOLERS AND FREEZERS PANELS; 9 YEARS OF SHIPMENTS

[2027–2035]

Discount rate	Trial standard level		
	1	2	3
	(billion 2022$)		
3 percent			−1.91
7 percent			−1.54

TABLE V.76—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR WALK-IN COOLERS AND FREEZERS REFRIGERATION SYSTEMS; 9 YEARS OF SHIPMENTS

[2027–2035]

Discount rate	Trial standard level		
	1	2	3
	(billion 2022$)		
3 percent	0.55	0.60	−9.18
7 percent	0.32	0.34	−6.42

The previous results reflect the use of a default trend to estimate the change in price for walk-in coolers and freezers over the analysis period (see section IV.F.1 of this document). DOE also conducted a sensitivity analysis that considered one scenario with a lower rate of price decline than the reference case and one scenario with a higher rate of price decline than the reference case. The results of these alternative cases are presented in appendix 10C of the NOPR TSD. In the high-price-decline case, the NPV of consumer benefits is higher than in the default case. In the low-price-decline case, the NPV of consumer benefits is lower than in the default case.

c. Indirect Impacts on Employment

DOE estimates that that amended energy conservation standards for walk-in coolers and freezers would reduce energy expenditures for consumers of those products, with the resulting net savings being redirected to other forms of economic activity. These expected shifts in spending and economic activity could affect the demand for labor. As described in section IV.N of this document, DOE used an input/output model of the U.S. economy to estimate indirect employment impacts of the TSLs that DOE considered. There are uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Therefore, DOE generated results for near-term timeframes (2027–2036), where these uncertainties are reduced.

The results suggest that the proposed standards would be likely to have a negligible impact on the net demand for labor in the economy. The net change in jobs is so small that it would be imperceptible in national labor statistics and might be offset by other, unanticipated effects on employment. Chapter 16 of the NOPR TSD presents detailed results regarding anticipated indirect employment impacts.

4. Impact on Utility or Performance of Products

As discussed in section III.F.1.d of this document, DOE has tentatively concluded that the standards proposed in this NOPR would not lessen the utility or performance of the walk-in coolers and freezers under consideration in this rulemaking. Manufacturers of these products currently offer units that meet or exceed the proposed standards.

5. Impact of Any Lessening of Competition

DOE considered any lessening of competition that would be likely to result from new or amended standards. As discussed in section III.F.1.e of this document, the Attorney General determines the impact, if any, of any lessening of competition likely to result from a proposed standard, and transmits such determination in writing to the Secretary, together with an analysis of the nature and extent of such impact. To assist the Attorney General in making this determination, DOE has provided DOJ with copies of this NOPR and the accompanying TSD for review. DOE will consider DOJ's comments on the proposed rule in determining whether to proceed to a final rule. DOE will publish and respond to DOJ's comments in that document. DOE invites comment from the public regarding the competitive impacts that are likely to result from this proposed rule. In addition, stakeholders may also provide comments separately to DOJ regarding these potential impacts. See the **ADDRESSES** section for information to send comments to DOJ.

6. Need of the Nation To Conserve Energy

Enhanced energy efficiency, where economically justified, improves the Nation's energy security, strengthens the economy, and reduces the environmental impacts (costs) of energy production. Reduced electricity demand due to energy conservation standards is also likely to reduce the cost of maintaining the reliability of the electricity system, particularly during peak-load periods. Chapter 15 in the NOPR TSD presents the estimated impacts on electricity generating capacity, relative to the no-new-standards case, for the TSLs that DOE considered in this rulemaking.

Energy conservation resulting from potential energy conservation standards for walk-in coolers and freezers is expected to yield environmental benefits in the form of reduced emissions of certain air pollutants and greenhouse gases. Table V.77 provides DOE's estimate of cumulative emissions reductions expected to result from the TSLs considered in this rulemaking. The emissions were calculated using the multipliers discussed in section IV.K. DOE reports annual emissions reductions for each TSL in chapter 13 of the NOPR TSD.

TABLE V.77—CUMULATIVE EMISSIONS REDUCTION FOR WALK-IN COOLERS AND FREEZERS SHIPPED IN 2027–2054

	Trial standard level		
	1	2	3
Power Sector Emissions			
CO_2 (million metric tons)	20.68	25.91	149.54
CH_4 (thousand tons)	1.55	1.94	11.63
N_2O (thousand tons)	0.22	0.27	1.63
NO_X (thousand tons)	9.96	12.48	75.08
SO_2 (thousand tons)	6.86	8.60	71.84
Hg (tons)	0.05	0.06	0.46
Upstream Emissions			
CO_2 (million metric tons)	2.07	2.60	11.49
CH_4 (thousand tons)	187.92	235.47	1086.42
N_2O (thousand tons)	0.01	0.01	0.06
NO_X (thousand tons)	32.23	40.38	174.00
SO_2 (thousand tons)	0.13	0.16	0.80
Hg (tons)	0.00	0.00	0.00
Total FFC Emissions			
CO_2 (million metric tons)	22.75	28.50	161.03
CH_4 (thousand tons)	189.47	237.41	1098.04
N_2O (thousand tons)	0.22	0.28	1.68
NO_X (thousand tons)	42.18	52.86	249.08
SO_2 (thousand tons)	6.99	8.76	72.64
Hg (tons)	0.05	0.06	0.47

Note: Negative values refer to an increase in emissions.

As part of the analysis for this rulemaking, DOE estimated monetary benefits likely to result from the reduced emissions of CO_2 that DOE estimated for each of the considered TSLs for walk-ins. Section IV.L of this document discusses the SC–CO_2 values that DOE used. Table V.78 presents the value of CO_2 emissions reduction at each TSL for each of the SC–CO_2 cases. The time-series of annual values is presented for the proposed TSL in chapter 14 of the NOPR TSD.

TABLE V.78—PRESENT VALUE OF CO_2 EMISSIONS REDUCTION FOR WALK-IN COOLERS AND FREEZERS SHIPPED IN 2027–2056

TSL	SC–CO_2 case			
	Discount rate and statistics			
	5% Average	3% Average	2.5% Average	3% 95th percentile
	(billion 2022$)			
1	0.24	1.02	1.59	3.11
2	0.30	1.28	1.99	3.89
3	0.90	3.81	5.94	11.58

As discussed in section IV.L.2 of this document, DOE estimated the climate benefits likely to result from the reduced emissions of methane and N_2O that DOE estimated for each of the considered TSLs for walk-in coolers and freezers. Table V.79 presents the value of the CH_4 emissions reduction at each TSL, and Table V.80 presents the value of the N_2O emissions reduction at each TSL. The time-series of annual values is presented for the proposed TSL in chapter 14 of the NOPR TSD.

TABLE V.79—PRESENT VALUE OF METHANE EMISSIONS REDUCTION FOR WALK-IN COOLERS AND FREEZERS SHIPPED IN 2027–2056

TSL	SC–CH_4 case			
	Discount rate and statistics			
	5% Average	3% Average	2.5% Average	3% 95th percentile
	(billion 2022$)			
1	0.09	0.27	0.37	0.71
2	0.11	0.34	0.47	0.89
3	0.34	1.00	1.40	2.66

TABLE V.80—PRESENT VALUE OF NITROUS OXIDE EMISSIONS REDUCTION FOR WALK-IN COOLERS AND FREEZERS SHIPPED IN 2027–2056

TSL	SC–N_2O case			
	Discount rate and statistics			
	5% Average	3% Average	2.5% Average	3% 95th percentile
	(billion 2022$)			
1	0.00	0.00	0.01	0.01
2	0.00	0.00	0.01	0.01
3	0.00	0.01	0.02	0.04

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 global and U.S. economy continues to evolve rapidly. DOE, together with other Federal agencies, will continue to review methodologies for estimating the monetary value of reductions in CO_2 and other GHG emissions. This ongoing review will consider the comments on this subject that are part of the public record for this and other rulemakings, as well as other methodological assumptions and issues. DOE notes that the proposed standards would be economically justified even without inclusion of monetized benefits of reduced GHG emissions.

DOE also estimated the monetary value of the health benefits associated with NO_X and SO_2 emissions reductions anticipated to result from the considered TSLs for walk-ins. The dollar-per-ton values that DOE used are discussed in section IV.L of this document. Table V.81 presents the present value for NO_X emissions reduction for each TSL calculated using 7-percent and 3-percent discount rates, and Table V.82 presents similar results for SO_2 emissions reductions. The results in these tables reflect application of EPA's low dollar-per-ton values, which DOE used to be conservative. The time-series of annual values is presented for the proposed TSL in chapter 14 of the NOPR TSD.

TABLE V.81—PRESENT VALUE OF NO_X EMISSIONS REDUCTION FOR WALK-INS SHIPPED IN 2027–2056

TSL	3% Discount rate	7% Discount rate
	(million 2022$)	
1	2,066.09	865.00
2	2,588.54	1,083.62
3	7,697.98	3,187.29

TABLE V.82—PRESENT VALUE OF SO_2 EMISSIONS REDUCTION FOR WALK-INS SHIPPED IN 2027–2056

TSL	3% Discount rate	7% Discount rate
	(million 2022$)	
1	478.11	204.03
2	599.00	255.59
3	1,778.80	750.45

Not all the public health and environmental benefits from the reduction of greenhouse gases, NOx, and SO_2 are captured in the values above, and additional unquantified benefits from the reductions of those pollutants as well as from the reduction of direct PM and other co-pollutants may be significant. DOE has not included monetary benefits of the reduction of Hg emissions because the amount of reduction is very small.

7. Other Factors

The Secretary of Energy, in determining whether a standard is economically justified, may consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VII)) No other factors were considered in this analysis.

8. Summary of Economic Impacts

Table V.83 through Table V.85 present the NPV values that result from adding the estimates of the potential economic benefits resulting from reduced GHG and NO_X and SO_2 emissions to the NPV of consumer benefits calculated for each TSL considered in this rulemaking. The consumer benefits are domestic U.S. monetary savings that occur as a result of purchasing the covered equipment, and are measured for the lifetime of products shipped in 2027–2056. The climate benefits associated with reduced GHG emissions resulting from the adopted standards are global benefits, and are also calculated based on the lifetime of walk-ins shipped in 2027–2056.

TABLE V.83—CONSUMER NPV COMBINED WITH PRESENT VALUE OF CLIMATE BENEFITS AND HEALTH BENEFITS FOR WALK-IN DOORS

Category	TSL 1	TSL 2	TSL 3
Using 3% discount rate for Consumer NPV and Health Benefits (billion 2022$)			
5% Average SC–GHG case	2.83	3.24	−5.83
3% Average SC–GHG case	3.25	3.74	−5.12
2.5% Average SC–GHG case	3.55	4.09	−4.62
3% 95th percentile SC–GHG case	4.37	5.05	−3.24
Using 7% discount rate for Consumer NPV and Health Benefits (billion 2022$)			
5% Average SC–GHG case	1.32	1.51	−3.61
3% Average SC–GHG case	1.75	2.01	−2.90
2.5% Average SC–GHG case	2.04	2.36	−2.40
3% 95th percentile SC–GHG case	2.86	3.32	−1.03

TABLE V.84—CONSUMER NPV COMBINED WITH PRESENT VALUE OF CLIMATE BENEFITS AND HEALTH BENEFITS FOR WALK-IN PANELS

Category	TSL 1	TSL 2	TSL 3
Using 3% discount rate for Consumer NPV and Health Benefits (billion 2022$)			
5% Average SC–GHG case			−3.73
3% Average SC–GHG case			−3.24
2.5% Average SC–GHG case			−2.90
3% 95th percentile SC–GHG case			−1.96
Using 7% discount rate for Consumer NPV and Health Benefits (billion 2022$)			
5% Average SC–GHG case			−2.41
3% Average SC–GHG case			−1.92
2.5% Average SC–GHG case			−1.58
3% 95th percentile SC–GHG case			−0.64

TABLE V.85—CONSUMER NPV COMBINED WITH PRESENT VALUE OF CLIMATE BENEFITS AND HEALTH BENEFITS FOR WALK-IN REFRIGERATION SYSTEMS

Category	TSL 1	TSL 2	TSL 3
Using 3% discount rate for Consumer NPV and Health Benefits (billion 2022$)			
5% Average SC–GHG case	3.10	3.73	−18.00
3% Average SC–GHG case	3.64	4.44	−15.61
2.5% Average SC–GHG case	4.02	4.93	−13.93
3% 95th percentile SC–GHG case	5.05	6.29	−9.32

TABLE V.85—CONSUMER NPV COMBINED WITH PRESENT VALUE OF CLIMATE BENEFITS AND HEALTH BENEFITS FOR WALK-IN REFRIGERATION SYSTEMS—Continued

Category	TSL 1	TSL 2	TSL 3
Using 7% discount rate for Consumer NPV and Health Benefits (billion 2022$)			
5% Average SC–GHG case	1.42	1.70	−9.54
3% Average SC–GHG case	1.96	2.41	−7.15
2.5% Average SC–GHG case	2.34	2.90	−5.47
3% 95th percentile SC–GHG case	3.38	4.26	−0.86

C. Conclusion

When considering new or amended energy conservation standards, the standards that DOE adopts for any type (or class) of covered product must be designed to achieve the maximum improvement in energy efficiency that the Secretary determines is technologically feasible and economically justified. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(A)) In determining whether a standard is economically justified, the Secretary must determine whether the benefits of the standard exceed its burdens by, to the greatest extent practicable, considering the seven statutory factors discussed previously. (42 U.S.C. 6295(o)(2)(B)(i)) The new or amended standard must also result in significant conservation of energy. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(3)(B))

For this NOPR, DOE considered the impacts of amended standards for walk-ins at each TSL, beginning with the maximum technologically feasible level, to determine whether that level was economically justified. Where the max-tech level was not justified, DOE then considered the next most efficient level and undertook the same evaluation until it reached the highest efficiency level that is both technologically feasible and economically justified and saves a significant amount of energy.

To aid the reader as DOE discusses the benefits and/or burdens of each TSL, tables in this section present a summary of the results of DOE's quantitative analysis for each TSL. In addition to the quantitative results presented in the tables, DOE also considers other burdens and benefits that affect economic justification. These include the impacts on identifiable subgroups of consumers who may be disproportionately affected by a national standard and impacts on employment.

1. Benefits and Burdens of TSLs Considered for Walk-Ins Standards

a. Doors

Table V.87, Table V.88, Table V.90, and Table V.91 summarize the quantitative impacts estimated for each TSL for walk-in display doors and non-display doors. National impacts for walk-in doors are measured over the lifetime of walk-ins purchased in the 30-year period that begins in the anticipated year of compliance with amended standards (2027–2056). The energy savings, emissions reductions, and value of emissions reductions refer to full-fuel-cycle results.

Display Doors

Walk-in display door efficiency levels contained in each TSL are shown in Table V.86 and described in section IV.E.1 of this document. Table V.87 and Table V.88 summarize the quantitative impacts estimated for each TSL for walk-in display doors.

TABLE V.86—WALK-IN DISPLAY DOORS EFFICIENCY LEVEL MAPPING BY TRIAL STANDARD LEVEL

Equipment class	TSL 1	TSL 2	TSL 3
Low Temperature (DW.L)	0	0	2
Medium Temperature (DW.M)	0	0	2

TABLE V.87—SUMMARY OF ANALYTICAL RESULTS FOR WALK-IN DISPLAY DOORS TSLS: NATIONAL IMPACTS

Category	TSL 1	TSL 2	TSL 3
Cumulative FFC National Energy Savings			
Quads	....	....	0.25
CO_2 (million metric tons)	....	....	4.5
CH_4 (thousand tons)	....	....	37.8
N_2O (thousand tons)	....	....	0.0
NO_X (thousand tons)	....	....	8.4
SO_2 (thousand tons)	....	....	1.4
Hg (tons)	....	....	0.01
Present Value of Benefits and Costs (3% discount rate, billion 2022$)			
Consumer Operating Cost Savings	....	....	0.86
Climate Benefits *	....	....	0.25
Health Benefits **	....	....	0.49
Total Monetized Benefits †	....	....	1.60
Consumer Incremental Product Costs ‡	....	....	8.41
Consumer Net Benefits	....	....	−7.54

TABLE V.87—SUMMARY OF ANALYTICAL RESULTS FOR WALK-IN DISPLAY DOORS TSLS: NATIONAL IMPACTS—Continued

Category	TSL 1	TSL 2	TSL 3
Total Net Monetized Benefits			−6.81
Present Value of Benefits and Costs (7% discount rate, billion 2022$)			
Consumer Operating Cost Savings			0.38
Climate Benefits *			0.25
Health Benefits **			0.20
Total Monetized Benefits †			0.83
Consumer Incremental Product Costs ‡			4.61
Consumer Net Benefits			−4.22
Total Net Monetized Benefits			−3.78

Note: This table presents the costs and benefits associated with walk-ins shipped in 2027–2056. These results include benefits to consumers which accrue after 2056 from the products shipped in 2027–2056.

* Climate benefits are calculated using four different estimates of the SC–CO_2, SC–CH_4 and SC–N_2O. Together, these represent the global SC–GHG. For presentational purposes of this table, the climate benefits associated with the average SC–GHG at a 3 percent discount rate are shown; however, DOE emphasizes the importance and value of considering the benefits calculated using all four sets of SC–GHG estimates. To monetize the benefits of reducing GHG emissions, this analysis uses the interim estimates presented in the *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990* published in February 2021 by the IWG.

** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. DOE is currently only monetizing (for NO_X and SO_2) $PM_{2.5}$ precursor health benefits and (for NO_X) ozone precursor health benefits, but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions. The health benefits are presented at real discount rates of 3 and 7 percent. See section IV.L of this document for more details.

† Total and net benefits include consumer, climate, and health benefits. For presentation purposes, total and net benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate.

‡ Costs include incremental equipment costs as well as installation costs.

TABLE V.88—SUMMARY OF ANALYTICAL RESULTS FOR WALK-INS DISPLAY DOORS TSLS: MANUFACTURER AND CONSUMER IMPACTS

Category	TSL 1 *	TSL 2 *	TSL 3 *
Manufacturer Impacts			
Industry NPV (*million 2022$*) (No-new-standards case INPV = 278.0).	278.0	278.0	215.5 to 355.6.
Industry NPV (*% change*)	—	—	(22.5) to 27.9.
Consumer Average LCC Savings (2022$)			
DW.L	—	—	(1,106).
DW.M	—	—	(1,247).
Shipment-Weighted Average *	—	—	(1,232).
Consumer Simple PBP (years)			
DW.L	—	—	44.0.
DW.M	—	—	99.1.
Shipment-Weighted Average *	—	—	93.2.
Percent of Consumers that Experience a Net Cost			
DW.L	—	—	100.
DW.M	—	—	100.
Shipment-Weighted Average *	—	—	100.

Parentheses indicate negative (−) values. The entry "—" means not applicable because there is no change in the standard at certain TSLs.

* Weighted by shares of each product class in total projected shipments in 2027.

For walk-in display doors, DOE first considered TSL 3, which represents the max-tech efficiency levels. At TSL 3, DOE expects display doors would require the use of vacuum-insulated glass as a substitute for the prescriptive minimum design of double-pane or triple-pane insulated glass packs for medium-temperature doors and low-temperature doors, respectively. TSL 3 would save an estimated 0.25 quads of energy, an amount DOE considers significant. Under TSL 3, the NPV of consumer benefit would be −$4.22 billion using a discount rate of 7 percent, and −$7.54 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 3 are 4.5 Mt of CO_2, 1.4 thousand tons of SO_2, 8.4 thousand tons of NO_X, 0.01 tons of Hg, 37.8 thousand tons of CH_4, and 0.0 thousand tons of N_2O. The estimated monetary value of the climate benefits from reduced GHG emissions (associated with the average SC–GHG at a 3-percent discount rate) at TSL 3 is $0.25 billion. The estimated monetary value of the health benefits from reduced SO_2 and NO_X emissions at TSL 3 is $ 0.20 billion using a 7-percent discount rate and $0.49 billion using a 3-percent discount rate.

Using a 7-percent discount rate for consumer benefits and costs, health benefits from reduced SO_2 and NO_X emissions, and the 3-percent discount rate case for climate benefits from reduced GHG emissions, the estimated total NPV at TSL 3 is −$6.81 billion. Using a 3-percent discount rate for all benefits and costs, the estimated total NPV at TSL 3 is −$3.78 billion. The estimated total NPV is provided for additional information, however DOE primarily relies upon the NPV of consumer benefits when determining whether a proposed standard level is economically justified.

At TSL 3 for walk-in display doors, the average LCC impact ranges from a savings of −$1,247 for DW.M to −$1,106 for DW.L. The simple payback period ranges from 44.0 years for DW.L to 99.1 years for DW.M. The fraction of consumers experiencing a net LCC cost is 100 percent for all walk-in display doors.

At TSL 3 for walk-in display doors, the projected change in INPV ranges from a decrease of $62.5 million to an increase of $77.6 million, which corresponds to a decrease of 22.5 percent and an increase of 27.9 percent, respectively. DOE estimates industry would invest $25.5 million to redesign walk-in display doors to incorporate vacuum-insulated glass.

DOE estimates that there are no walk-in display door shipments that currently meet the max-tech efficiency levels. For the 10 OEMs that manufacture walk-in display doors, implementing vacuum-insulated glass would require significant engineering resources and testing time to ensure adequate durability of their doors in all commercial settings. In interviews, manufacturers emphasized that there are currently a very limited number of suppliers of vacuum-insulated glass. Door manufacturers expressed concerns that the 3-year conversion period between the publication of the final rule and the compliance date of the amended energy conservation standard might be insufficient to design and test a full portfolio of vacuum-insulated doors that meet the max-tech efficiencies and maintain their internal metrics over the door lifetime.

The Secretary tentatively concludes that at TSL 3 for all walk-in display doors, the benefits of energy savings, emission reductions, and the estimated monetary value of the emissions reductions would be outweighed by the economic burden in the form of negative NPV of consumer benefits, and the impacts on manufacturers, including the large conversion costs and profit margin impacts that could result in a large reduction in INPV. No manufacturers currently offer equipment that meet the efficiency levels required at TSL 3. Walk-in display door manufacturers raised concern about their ability to incorporate vacuum insulated glass across all their offerings, while also maintaining important display door performance characteristics, within three years. Consequently, the Secretary has tentatively concluded that TSL 3 is not economically justified.

Although DOE considered proposed amended standard levels for walk-in display doors by grouping the efficiency levels for low- and medium-temperature display doors into TSLs, DOE evaluates all analyzed efficiency levels in its analysis. As defined in section IV.E.1, TSL 2 and TSL 1 require efficiency levels with positive consumer NPV at a 7-percent discount rate. As shown in appendix 8E of the NOPR TSD, none of the efficiency level improvements to walk-in display doors yield positive consumer benefit for any of the considered equipment classes, resulting in TSL 2 and TSL 1 with efficiency levels at the current baseline.

Therefore, based on the previous considerations, the Secretary is tentatively proposing to not amend energy conservation standards for walk-in display doors at this time.

Non-Display Doors

Walk-in non-display door efficiency levels contained in each TSL are shown in Table V.89 and described in section IV.E.1 of this document. Table V.90 and Table V.91 summarize the quantitative impacts estimated for each TSL for walk-in non-display doors.

TABLE V.89—WALK-IN NON-DISPLAY DOOR EFFICIENCY LEVEL MAPPING BY TRIAL STANDARD LEVEL

Equipment class	TSL 1	TSL 2	TSL 3
Non-Motorized Low Temperature (NM.L)	3	3	5
Non-Motorized Medium Temperature (NM.M)	1	3	6
Motorized Low Temperature (NO.L)	3	3	5
Motorized Medium Temperature (NO.M)	1	3	6

TABLE V.90—SUMMARY OF ANALYTICAL RESULTS FOR WALK-IN NON-DISPLAY DOORS TSLS: NATIONAL IMPACTS

Category	TSL 1	TSL 2	TSL 3
Cumulative FFC National Energy Savings			
Quads	0.54	0.64	0.67
CO_2 (million metric tons)	10.0	11.8	12.4
CH_4 (thousand tons)	82.7	97.6	102.7
N_2O (thousand tons)	0.1	0.1	0.1
NO_X (thousand tons)	18.4	21.8	22.9
SO_2 (thousand tons)	3.1	3.6	3.8
Hg (tons)	0.02	0.02	0.03
Present Value of Benefits and Costs (3% discount rate, billion 2022$)			
Consumer Operating Cost Savings	1.99	2.35	2.47
Climate Benefits *	0.57	0.67	0.71
Health Benefits **	1.12	1.33	1.40
Total Monetized Benefits †	3.68	4.35	4.58
Consumer Incremental Product Costs ‡	0.43	0.61	2.89

TABLE V.90—SUMMARY OF ANALYTICAL RESULTS FOR WALK-IN NON-DISPLAY DOORS TSLS: NATIONAL IMPACTS—Continued

Category	TSL 1	TSL 2	TSL 3
Consumer Net Benefits	1.56	1.74	−0.41
Total Net Monetized Benefits	3.25	3.74	1.69
Present Value of Benefits and Costs (7% discount rate, billion 2022$)			
Consumer Operating Cost Savings	0.93	1.11	1.16
Climate Benefits *	0.57	0.67	0.71
Health Benefits **	0.48	0.56	0.59
Total Monetized Benefits †	1.98	2.34	2.47
Consumer Incremental Product Costs ‡	0.23	0.34	1.59
Consumer Net Benefits	0.70	0.77	−0.43
Total Net Monetized Benefits	1.75	2.01	0.88

Note: This table presents the costs and benefits associated with walk-ins shipped in 2027–2056. These results include benefits to consumers which accrue after 2056 from the products shipped in 2027–2056.

* Climate benefits are calculated using four different estimates of the SC–CO_2, SC–CH_4 and SC–N_2O. Together, these represent the global SC–GHG. For presentational purposes of this table, the climate benefits associated with the average SC–GHG at a 3 percent discount rate are shown; however, DOE emphasizes the importance and value of considering the benefits calculated using all four sets of SC–GHG estimates. To monetize the benefits of reducing GHG emissions, this analysis uses the interim estimates presented in the *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990 published in February 2021 by the IWG.*

** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. DOE is currently only monetizing (for NO_X and SO_2) $PM_{2.5}$ precursor health benefits and (for NO_X) ozone precursor health benefits, but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions. The health benefits are presented at real discount rates of 3 and 7 percent. See section IV.L of this document for more details.

† Total and net benefits include consumer, climate, and health benefits. For presentation purposes, total and net benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate.

‡ Costs include incremental equipment costs as well as installation costs.

TABLE V.91—SUMMARY OF ANALYTICAL RESULTS FOR WALK-IN NON-DISPLAY DOORS TSLS: MANUFACTURER AND CONSUMER IMPACTS

Category	TSL 1 *	TSL 2 *	TSL 3 *
Manufacturer Impacts			
Industry NPV (*million 2022$*) (No-new-standards case INPV = 536.7)	522.6 to 529.4	511.2 to 522.5	485.1 to 549.4
Industry NPV *(% change)*	(2.6) to (1.4)	(4.8) to (2.6)	(9.6) to 2.4
Consumer Average LCC Savings (2022$)			
NM.L	724	723	307
NM.M	203	86	(291)
NO.L	1,194	1,192	932
NO.M	306	113	(266)
Shipment-Weighted Average *	388	308	(80)
Consumer Simple PBP (years)			
NM.L	1.3	1.3	2.8
NM.M	2.4	3.2	8.2
NO.L	1.0	1.0	2.1
NO.M	1.8	2.4	6.3
Shipment-Weighted Average *	2.0	2.5	6.3
Percent of Consumers that Experience a Net Cost			
NM.L	2	2	37
NM.M	2	11	96
NO.L	1	2	9
NO.M	0	3	95
Shipment-Weighted Average *	2	2	37

Parentheses indicate negative (−) values. The entry "—" means not applicable because there is no change in the standard at certain TSLs.

* Weighted by shares of each product class in total projected shipments in 2027.

For walk-in non-display doors, DOE first considered TSL 3, which represents the max-tech efficiency levels. At TSL 3, DOE expects all non-display doors would require the following additional design options: anti-sweat heater controls, improved framing systems, reduced anti-sweat heat, and insulation thickness of 6 inches.

For walk-in non-display doors, TSL 3 would save an estimated 0.68 quads of energy, an amount DOE considers significant. Under TSL 3, the NPV of consumer benefits would be −$0.43 billion using a discount rate of 7 percent, and −$0.41 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 3 are 12.4 Mt of CO_2, 3.8 thousand tons of SO_2, 22.9 thousand tons of NO_X, 0.03 tons of Hg, 102.7 thousand tons of CH_4, and 0.1 thousand tons of N_2O. The estimated monetary value of the climate benefits from reduced GHG emissions (associated with the average SC–GHG at a 3-percent discount rate) at TSL 3 is $0.71 billion. The estimated monetary value of the health benefits from reduced SO_2 and NO_X emissions at TSL 3 is $0.59 billion using a 7-percent discount rate and $1.40 billion using a 3-percent discount rate.

Using a 7-percent discount rate for consumer benefits and costs, health benefits from reduced SO_2 and NO_X emissions, and the 3-percent discount rate case for climate benefits from reduced GHG emissions, the estimated total NPV at TSL 3 is $0.88 billion. Using a 3-percent discount rate for all benefits and costs, the estimated total NPV at TSL 3 is $1.69 billion. The estimated total NPV is provided for additional information, however DOE primarily relies upon the NPV of consumer benefits when determining whether a proposed standard level is economically justified.

At TSL 3, the average LCC impact ranges from a savings of −$291 for medium-temperature manual non-display doors to $932 for low-temperature motorized non-display doors. The simple payback period ranges from 2.1 years for low-temperature motorized non-display doors to 8.2 years for medium-temperature manual non-display doors. The fraction of consumers experiencing a net LCC cost ranges from 7 percent for low-temperature motorized non-display doors to 78 percent for medium-temperature manual non-display doors.

At TSL 3, the projected change in INPV ranges from a decrease of $51.6 million to an increase of $12.7 million, which corresponds to a decrease of 9.6 percent and an increase of 2.4 percent, respectively. DOE estimates industry would invest $48.3 million to purchase new foaming equipment and tooling to increase insulation thickness to 6 inches for all walk-in non-display doors.

DOE estimates that there are no walk-in non-display door shipments that currently meet the max-tech efficiency levels. For the 43 OEMs that manufacture walk-in non-display doors, increasing insulation thickness from the assumed baseline thickness of 3.5 inches for medium-temperature and 4 inches for low-temperature non-display doors to 6 inches would require purchasing new foaming equipment since most manufacturers are only able to manufacture non-display doors up to 5 inches thick. Additionally, non-display door manufacturers were concerned about the flow of foam and the curing time of foam at max-tech. New foaming equipment to accommodate 6-inch non-display doors would require significant capital investment and is a key driver of capital conversion costs. Of the 43 non-display door OEMs identified, 40 are small, domestic businesses.

Furthermore, of the 43 walk-in non-display door OEMs, 39 OEMs also produce walk-in panels. Most of these OEMs use the same panel foaming systems to produce non-display doors that they use to produce panels; however, panel shipments dwarf shipments of non-display doors. Because the same product lines are used, these OEMs offer non-display doors in the same range of thickness as panels. It is typical to align the thickness of non-display doors and panels to avoid a situation where the walk-in door protrudes from the surrounding panel enclosure. Were the thickness of non-display doors and panels to be different in an installation, consumers may need to prematurely replace the surrounding panels to accommodate a thicker non-display door. Thus, a standard that would require 6-inch-thick non-display doors may inadvertently force consumers to purchase some or all panels of the walk-in that are 6-inches thick so that the thickness of the entire walk-in is the same or that there is appropriate structural transition between the door and panels of differing thicknesses. As discussed in section V.C.1.b, panels of 6-inch thickness do not have positive consumer benefits.

The Secretary tentatively concludes that at TSL 3 for walk-in non-display doors, the benefits of energy savings, emission reductions, and the estimated monetary value of the emissions reductions would be outweighed by the economic burden of negative NPV of consumer benefits, and the impacts on manufacturers, including the conversion costs and profit margin impacts that could result in a reduction in INPV, and the absence of manufacturers currently offering products meeting the efficiency levels required at this TSL, including all small businesses of non-display doors. Manufacturers of non-display doors would need to increase insulation thickness to 6 inches across all equipment classes, necessitating large capital investments. Additionally, no walk-in non-display door manufacturers offer models in the CCD that meet the efficiency level required at TSL 3. Nearly all the non-display door OEMs identified are small, domestic businesses. Lastly, to purchase walk-in doors at TSL 3, consumers may also be required to purchase some or all panels of their walk-ins at a level that is not economically justified for the thickness of the door and panel to be uniform. Consequently, the Secretary has tentatively concluded that TSL 3 is not economically justified.

DOE then considered TSL 2 for walk-in non-display doors, which represents efficiency level 3 for all non-display doors. At TSL 2, DOE expects that all walk-in non-display doors would require anti-sweat heater controls, improved framing systems and reduced anti-sweat heat.

TSL 2 would save an estimated 0.64 quads of energy, an amount DOE considers significant. Under TSL 2, the NPV of consumer benefit would be $0.77 billion using a discount rate of 7 percent, and $1.74 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 2 are 11.8 Mt of CO_2, 3.6 thousand tons of SO_2, 21.8 thousand tons of NO_X, 0.02 tons of Hg, 97.6 thousand tons of CH_4, and 0.1 thousand tons of N_2O. The estimated monetary value of the climate benefits from reduced GHG emissions (associated with the average SC–GHG at a 3-percent discount rate) at TSL 2 is $0.67 billion. The estimated monetary value of the health benefits from reduced SO_2 and NO_X emissions at TSL 2 is $0.56 billion using a 7-percent discount rate and $1.33 billion using a 3-percent discount rate.

Using a 7-percent discount rate for consumer benefits and costs, health benefits from reduced SO_2 and NO_X emissions, and the 3-percent discount rate case for climate benefits from reduced GHG emissions, the estimated total NPV at TSL 2 is $2.01 billion. Using a 3-percent discount rate for all benefits and costs, the estimated total NPV at TSL 2 is $3.74 billion. The estimated total NPV is provided for additional information, however DOE primarily relies upon the NPV of consumer benefits when determining whether a proposed standard level is economically justified.

At TSL 2, the average LCC impact ranges from a savings of $86 for medium-temperature, manual non-display doors to $1,192 for low-temperature motorized non-display doors. The simple payback period ranges from 1.0 years for low-temperature, motorized non-display doors to 3.2 years for medium-temperature, manual non-display doors. The fraction of consumers experiencing a net LCC cost ranges from 2 percent for low-temperature, motorized non-display doors to 11 percent for medium-temperature, manual non-display doors.

At TSL 2, the projected change in INPV ranges from a decrease of $25.5 million to a decrease of $14.2 million, which corresponds to decreases of 4.8 percent and 2.6 percent, respectively. DOE estimates that industry must invest $28.9 million to comply with standards for non-display doors set at TSL 2. DOE estimates that approximately 12 percent of non-display door shipments currently meet TSL 2 efficiencies. At this level, DOE expects manufacturers would need to update non-display door models to incorporate anti-sweat heater controls, improved door frame designs, and reduced anti-sweat heat. DOE does not expect manufacturers would need to increase insulation thickness to meet the efficiency levels required by TSL 2.

After considering the analysis and weighing the benefits and burdens, the Secretary has tentatively concluded that a standard set at TSL 2 for walk-in non-display doors would be economically justified. At this TSL, the average LCC savings for all non-display door consumers are positive, and the greatest fraction of consumers to experience net cost is estimated at 11 percent for medium-temperature, manual non-display doors. At TSL 2, the FFC national energy savings are significant and the NPV of consumer benefits is positive using both a 3-percent and 7-percent discount rate. Notably, the benefits to consumers vastly outweigh the cost to manufacturers. At TSL 2, the NPV of consumer benefits, even measured at the more conservative discount rate of 7 percent is over 28 times higher than the maximum estimated manufacturers' loss in INPV. The standard levels at TSL 2 are economically justified even without weighing the estimated monetary value of emissions reductions. When those emissions reductions are included—representing $0.67 billion in climate benefits (associated with the average SC–GHG at a 3-percent discount rate), and $1.33 billion (using a 3-percent discount rate) or $0.56 billion (using a 7-percent discount rate) in health benefits—the rationale for setting standards at TSL 2 for walk-in doors is further strengthened.

Therefore, based on the previous considerations, DOE proposes to adopt the energy conservation standards for walk-in non-display doors at TSL 2. The proposed amended energy conservation standards for walk-in non-display doors, which are expressed as kWh/year, are shown in Table V.92.

TABLE V.92—PROPOSED AMENDED ENERGY CONSERVATION STANDARDS FOR WALK-IN NON-DISPLAY DOORS

Equipment class			Maximum daily energy consumption (kWh/day) *
Display/non-display	Opening mechanism	Temperature	
Non-Display	Manual	Medium	$0.01 \times A_{nd} + 0.25$
		Low	$0.06 \times A_{nd} + 1.32$
	Manual	Medium	$0.01 \times A_{nd} + 0.39$
		Low	$0.05 \times A_{nd} + 1.56$

* A_{nd} is the representative value of surface area of the non-display door as determined in accordance with the DOE test procedure at 10 CFR part 431, subpart R, appendix A and applicable sampling plans.

b. Panels

The efficiency levels contained in each TSL are shown in Table V.93 and described in section IV.E.1 of this document. Table V.94 and Table V.95 summarize the quantitative impacts estimated for each TSL for walk-in panels. The national impacts are measured over the lifetime of walk-ins purchased in the 30-year period that begins in the anticipated year of compliance with amended standards (2027–2056). The energy savings, emissions reductions, and value of emissions reductions refer to full-fuel-cycle results.

TABLE V.93—WALK-IN PANEL EFFICIENCY LEVEL MAPPING BY TRIAL STANDARD LEVEL

Equipment class	TSL 1	TSL 2	TSL 3
Floor Low Temperature (PF.L)	0	0	3
Structural Low Temperature (PS.L)	0	0	2
Structural Medium Temperature (PS.M)	0	0	3

TABLE V.94—SUMMARY OF ANALYTICAL RESULTS FOR WALK-IN COOLERS AND FREEZERS PANEL TSLS: NATIONAL IMPACTS

Category	TSL 1	TSL 2	TSL 3
Cumulative FFC National Energy Savings			
Quads			0.64
CO_2 (*million metric tons*)			11.7
CH_4 (*thousand tons*)			98.2
N_2O (*thousand tons*)			0.1
NO_X (*thousand tons*)			21.8
SO_2 (*thousand tons*)			3.6
Hg (*tons*)			0.02

TABLE V.94—SUMMARY OF ANALYTICAL RESULTS FOR WALK-IN COOLERS AND FREEZERS PANEL TSLS: NATIONAL IMPACTS—Continued

Category	TSL 1	TSL 2	TSL 3
Present Value of Benefits and Costs (3% discount rate, billion 2022$)			
Consumer Operating Cost Savings	....	....	2.28
Climate Benefits *	....	....	0.65
Health Benefits **	....	....	1.28
Total Monetized Benefits †	....	....	4.22
Consumer Incremental Product Costs ‡	....	....	7.46
Consumer Net Benefits	....	....	−5.18
Total Net Monetized Benefits	....	....	−3.24
Present Value of Benefits and Costs (7% discount rate, billion 2022$)			
Consumer Operating Cost Savings	....	....	1.02
Climate Benefits *	....	....	0.65
Health Benefits **	....	....	0.52
Total Monetized Benefits †	....	....	2.20
Consumer Incremental Product Costs ‡	....	....	4.12
Consumer Net Benefits	....	....	−3.10
Total Net Monetized Benefits	....	....	−1.92

Note: This table presents the costs and benefits associated with walk-in coolers and freezers shipped in 2027–2056. These results include benefits to consumers which accrue after 2056 from the products shipped in 2027–2056.

* Climate benefits are calculated using four different estimates of the SC–CO_2, SC–CH_4 and SC–N_2O. Together, these represent the global SC–GHG. For presentational purposes of this table, the climate benefits associated with the average SC–GHG at a 3 percent discount rate are shown; however, DOE emphasizes the importance and value of considering the benefits calculated using all four sets of SC–GHG estimates. To monetize the benefits of reducing GHG emissions, this analysis uses the interim estimates presented in the *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990 published in February 2021 by the IWG.*

** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. DOE is currently only monetizing (for NO_X and SO_2) $PM_{2.5}$ precursor health benefits and (for NO_X) ozone precursor health benefits, but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions. The health benefits are presented at real discount rates of 3 and 7 percent. See section IV.L of this document for more details.

† Total and net benefits include consumer, climate, and health benefits. For presentation purposes, total and net benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate.

‡ Costs include incremental equipment costs as well as installation costs.

TABLE V.95—SUMMARY OF ANALYTICAL RESULTS FOR WALK-IN COOLERS AND FREEZERS PANEL TSLS: MANUFACTURER AND CONSUMER IMPACTS

Category	TSL 1 *	TSL 2 *	TSL 3 *
Manufacturer Impacts			
Industry NPV (*million 2022$*) (No-new-standards case INPV = 875.2)	875.2	875.2	676.5 to 787.4.
Industry NPV *(% change)*	—	—	(22.7) to (10.0).
Consumer Average LCC Savings per ft² (2022$)			
PF.L	—	—	(1.61).
PS.L	—	—	(0.50).
PS.M	—	—	(2.33).
Shipment-Weighted Average *	—	—	(1.92).
Consumer Simple PBP (years)			
PF.L	—	—	26.1.
PS.L	—	—	10.1.
PS.M	—	—	54.0.
Shipment-Weighted Average *	—	—	43.7.
Percent of Consumers that Experience a Net Cost (%)			
PF.L	—	—	95.
PS.L	—	—	64.
PS.M	—	—	100.
Shipment-Weighted Average *	—	—	92.

Parentheses indicate negative (−) values. The entry "—" means not applicable because there is no change in the standard at certain TSLs.
* Weighted by shares of each product class in total projected shipments in 2027.

For panels, DOE first considered TSL 3, which represents the max-tech efficiency levels. At TSL 3, DOE expects that all panels would require an insulation thickness of 6 inches.

TSL 3 would save an estimated 0.64 quads of energy, an amount DOE considers significant. Under TSL 3, the NPV of consumer benefit would be −$3.10 billion using a discount rate of 7 percent, and −$5.18 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 3 are 11.79 Mt of CO_2, 3.6 thousand tons of SO_2, 21.8 thousand tons of NO_X, 0.02 tons of Hg, 982 thousand tons of CH_4, and 0.1 thousand tons of N_2O. The estimated monetary value of the climate benefits from reduced GHG emissions (associated with the average SC–GHG at a 3-percent discount rate) at TSL 3 is $0.65 billion. The estimated monetary value of the health benefits from reduced SO_2 and NO_X emissions at TSL 3 is $0.52 billion using a 7-percent discount rate and $1.28 billion using a 3-percent discount rate.

Using a 7-percent discount rate for consumer benefits and costs, health benefits from reduced SO_2 and NO_X emissions, and the 3-percent discount rate case for climate benefits from reduced GHG emissions, the estimated total NPV at TSL 3 is −$1.92 billion. Using a 3-percent discount rate for all benefits and costs, the estimated total NPV at TSL 3 is −$3.24 billion. The estimated total NPV is provided for additional information, however DOE primarily relies upon the NPV of consumer benefits when determining whether a proposed standard level is economically justified.

At TSL 3, the average LCC impact ranges from a savings of −$2.33 per square foot of panel for medium-temperature, structural panels to −$0.50 per square foot of panel for low-temperature, structural panels. The simple payback period ranges from 10.1 years for low-temperature, structural panels to 54.0 years for medium-temperature, structural panels. The fraction of consumers experiencing a net LCC cost ranges from 64 percent for low-temperature, structural panels to 100 percent for medium-temperature, structural panels.

At TSL 3, the projected change in INPV ranges from a decrease of $198.8 million to a decrease of $87.9 million, which corresponds to decreases of 22.7 percent and 10.0 percent, respectively. DOE estimates that industry must invest $241.3 million to update panel designs and purchase new foaming equipment and tooling to increase insulation thickness to 6 inches across all panel models.

DOE estimates that 3 percent of walk-in panel shipments currently meet the max-tech levels. Increasing the insulation thickness for all panel equipment classes to 6 inches would require significant capital investment. Like walk-in non-display doors, most manufacturers are currently able to manufacture walk-in panels up to 5 inches thick. A standard level necessitating 6-inch panels would likely require new, costly foaming equipment for all manufacturers. Additionally, DOE estimates that every additional inch of foam increases panel cure times by roughly 10 minutes, which means that manufacturers would likely need to purchase additional equipment to maintain existing throughput. Some OEMs may need to invest in additional manufacturing space to accommodate the extra foaming stations. Of the 42 walk-in panel OEMs, 38 OEMs are small, domestic businesses. In interviews, manufacturers expressed concern about industry's ability to source the necessary foaming equipment to maintain existing production capacity within the 3-year compliance period due to the long lead times and limited number of foam fixture suppliers.

The Secretary tentatively concludes that at TSL 3 for walk-in panels, the benefits of energy savings, emission reductions, and the estimated monetary value of the emissions reductions would be outweighed by the economic burden, in the form of negative NPV, on many consumers, and the impacts on manufacturers, including the large conversion costs, profit margin impacts that could result in a large reduction in INPV, and the small number of manufacturers currently offering products meeting the efficiency levels required at this TSL, including most small businesses. A majority of panel consumers would experience a net cost ranging from 64 percent for low-temperature, structural panels to 100 percent for medium-temperature, structural panels and the average LCC savings would be negative. The potential reduction in INPV could be as high as 22.7 percent. The drop in industry value and reduction in free cash flow after the compliance year is driven by a range of factors, but most notably the changes are driven by conversion cost investments manufacturers must make to redesign and produce more efficient walk-in panels. Most manufacturers would need to dedicate significant resources to purchase all new foaming equipment. Due to the longer curing times, some manufacturers may need to both replace existing foaming equipment and purchase additional foaming equipment to maintain current production capacity. Furthermore, most panel manufacturers are small, domestic manufacturers. Consequently, the Secretary has tentatively concluded that TSL 3 is not economically justified.

Although DOE considered proposed amended standard levels for walk-in panels by grouping the efficiency levels for low- and medium-temperature structural panels and low-temperature floor panels into TSLs, DOE evaluates all analyzed efficiency levels in its analysis. As defined in section IV.E.1 of this document, TSL 2 and TSL 1 require efficiency levels with positive consumer NPV at a 7 percent discount rate. As shown in appendix 8E of the NOPR TSD, none of the efficiency level improvements to insulated panels yield positive consumer benefit for any of the considered equipment classes, resulting in TSL 2 and TSL 1 with efficiency levels at the current baseline.

Therefore, based on the previous considerations, the Secretary is tentatively proposing to not amend energy conservation standards for walk-in panels at this time.

c. Refrigeration Systems

The efficiency levels contained in each TSL are shown in Table V.96 and described in section IV.E.1 of this document. Table V.97 and Table V.98 summarize the quantitative impacts estimated for each TSL for walk-ins. The national impacts are measured over the lifetime of walk-ins purchased in the 30-year period that begins in the anticipated year of compliance with amended standards (2027–2056). The energy savings, emissions reductions, and value of emissions reductions refer to full-fuel-cycle results.

TABLE V.96—WALK-IN REFRIGERATION SYSTEM EFFICIENCY LEVELS BY TRIAL STANDARD LEVEL

Type	Equipment class	Capacity (kBtu/hr)	TSL 1	TSL 2	TSL 3
Dedicated Condensing Systems	DC.L.I	3	1	1	2
	DC.L.I	9	0	0	1
	DC.L.I	25	2	2	3

TABLE V.96—WALK-IN REFRIGERATION SYSTEM EFFICIENCY LEVELS BY TRIAL STANDARD LEVEL—Continued

Type	Equipment class	Capacity (kBtu/hr)	TSL 1	TSL 2	TSL 3
	DC.L.I	54	1	1	2
	DC.L.O	3	2	2	3
	DC.L.O	9	3	3	5
	DC.L.O	25	5	7	8
	DC.L.O	54	3	4	5
	DC.L.O	75	3	3	5
	DC.M.I	9	0	0	1
	DC.M.I	25	1	1	2
	DC.M.I	54	2	2	3
	DC.M.I	75	2	2	3
	DC.M.O	9	1	2	7
	DC.M.O	25	2	3	8
	DC.M.O	54	3	3	7
	DC.M.O	75	3	3	8
	DC.M.O	124	2	3	8
Single-Packaged Dedicated Condensing Systems	SP.H.I	2	1	1	2
	SP.H.I	7	2	2	2
	SP.H.ID	2	2	2	2
	SP.H.ID	7	2	2	2
	SP.H.O	2	4	5	6
	SP.H.O	7	3	5	6
	SP.H.OD	2	4	5	6
	SP.H.OD	7	3	6	6
	SP.L.I	2	4	4	7
	SP.L.I	6	2	2	3
	SP.L.O	2	0	0	4
	SP.L.O	6	0	0	4
	SP.M.I	2	2	3	5
	SP.M.I	9	1	1	3
	SP.M.O	2	5	7	9
	SP.M.O	9	3	3	5
Unit Coolers	UC.H.I	9	0	0	1
	UC.H.I	25	0	0	1
	UC.H.ID	9	1	1	1
	UC.H.ID	25	1	1	1
	UC.L	3	1	2	2
	UC.L	9	2	2	2
	UC.L	25	1	2	2
	UC.L	54	2	2	2
	UC.L	75	1	2	2
	UC.M	3	1	2	2
	UC.M	9	2	2	2
	UC.M	25	1	2	2
	UC.M	54	2	2	2
	UC.M	75	1	2	2

TABLE V.97—SUMMARY OF ANALYTICAL RESULTS FOR WALK-IN REFRIGERATION SYSTEM TSLS: NATIONAL IMPACTS

Category	TSL 1	TSL 2	TSL 3
Cumulative FFC National Energy Savings			
Quads	0.70	0.91	3.10
CO_2 (*million metric tons*)	12.8	16.7	56.8
CH_4 (*thousand tons*)	106.8	139.8	474.0
N_2O (*thousand tons*)	0.1	0.2	0.6
NO_X (*thousand tons*)	23.8	31.1	105.4
SO_2 (*thousand tons*)	3.9	5.1	17.4
Hg (*tons*)	0.03	0.04	0.12
Present Value of Benefits and Costs (3% discount rate, billion 2022$)			
Consumer Operating Cost Savings	1.91	2.31	−9.16
Climate Benefits *	0.72	0.95	3.22
Health Benefits **	1.42	1.86	6.31
Total Monetized Benefits †	4.06	5.12	0.37
Consumer Incremental Product Costs ‡	0.42	0.69	15.99
Consumer Net Benefits	1.49	1.62	−25.14
Total Net Monetized Benefits	3.64	4.44	−15.61

TABLE V.97—SUMMARY OF ANALYTICAL RESULTS FOR WALK-IN REFRIGERATION SYSTEM TSLS: NATIONAL IMPACTS—Continued

Category	TSL 1	TSL 2	TSL 3
Present Value of Benefits and Costs (7% discount rate, billion 2022$)			
Consumer Operating Cost Savings	0.88	1.06	−4.17
Climate Benefits *	0.72	0.95	3.22
Health Benefits **	0.59	0.77	2.63
Total Monetized Benefits †	2.19	2.79	1.67
Consumer Incremental Product Costs ‡	0.23	0.38	8.82
Consumer Net Benefits	0.64	0.68	−12.99
Total Net Monetized Benefits	1.96	2.41	−7.15

Note: This table presents the costs and benefits associated with walk-in coolers and freezers shipped in 2027–2056. These results include benefits to consumers which accrue after 2056 from the products shipped in 2027–2056.

* Climate benefits are calculated using four different estimates of the SC–CO_2, SC–CH_4 and SC–N_2O. Together, these represent the global SC–GHG. For presentational purposes of this table, the climate benefits associated with the average SC–GHG at a 3 percent discount rate are shown; however, DOE emphasizes the importance and value of considering the benefits calculated using all four sets of SC–GHG estimates. To monetize the benefits of reducing GHG emissions, this analysis uses the interim estimates presented in the *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990* published in February 2021 by the IWG.

** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. DOE is currently only monetizing (for NO_X and SO_2) $PM_{2.5}$ precursor health benefits and (for NO_X) ozone precursor health benefits, but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions. The health benefits are presented at real discount rates of 3 and 7 percent. See section IV.L of this document for more details.

† Total and net benefits include consumer, climate, and health benefits. For presentation purposes, total and net benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate.

‡ Costs include incremental equipment costs as well as installation costs.

TABLE V.98—SUMMARY OF ANALYTICAL RESULTS FOR WALK-IN COOLERS AND FREEZERS REFRIGERATION SYSTEM TSLS: MANUFACTURER AND CONSUMER IMPACTS

Category	TSL 1 *	TSL 2 *	TSL 3 *
Manufacturer Impacts			
Industry NPV (*million 2022$*) (No-new-standards case INPV = 490.1)	447.2 to 453.0	442.2 to 452.2	330.5 to 546.2
Industry NPV (*% change*)	(8.7) to (7.6)	(9.8) to (7.7)	(32.6) to 11.5
Consumer Average LCC Savings (2022$)			
DC.L.I	163	163	(5,218)
DC.L.O	237	172	(15,792)
DC.M.I	567	567	(2,047)
DC.M.O	101	136	(1,896)
SP.H.I	124	124	103
SP.H.ID	296	296	296
SP.H.O	159	126	(53)
SP.H.OD	437	305	270
SP.L.I	180	180	(1,575)
SP.L.O	—	—	(1,278)
SP.M.I	114	103	(1,577)
SP.M.O	186	177	(1,116)
UC.H	—	—	(152)
UC.H.ID	237	237	237
UC.L	1,080	1,306	1,306
UC.M	170	212	212
Shipment-Weighted Average *	308	353	(2,384)
Consumer Simple PBP (years)			
DC.L.I	4.0	4.0	inf
DC.L.O	1.4	3.6	inf
DC.M.I	3.4	3.4	inf
DC.M.O	1.6	2.6	21.6
SP.H.I	1.3	1.3	2.5
SP.H.ID	1.7	1.7	1.7
SP.H.O	0.4	2.9	9.0
SP.H.OD	0.2	3.4	3.8
SP.L.I	3.8	3.8	inf
SP.L.O			39.0
SP.M.I	3.0	3.5	inf
SP.M.O	0.9	1.2	50.8
UC.H			inf
UC.H.ID	0.7	0.7	0.7
UC.L	0.9	1.2	1.2

TABLE V.98—SUMMARY OF ANALYTICAL RESULTS FOR WALK-IN COOLERS AND FREEZERS REFRIGERATION SYSTEM TSLS: MANUFACTURER AND CONSUMER IMPACTS—Continued

Category	TSL 1 *	TSL 2 *	TSL 3 *
UC.M	2.0	2.0	2.0
Shipment-Weighted Average *	2.0	2.4	32.0
Percent of Consumers that Experience a Net Cost (%)			
DC.L.I	11	11	100
DC.L.O	0	8	100
DC.M.I	1	1	100
DC.M.O	0	1	96
SP.H.I	2	2	3
SP.H.ID	0	0	0
SP.H.O	0	3	81
SP.H.OD	0	4	13
SP.L.I	7	7	100
SP.L.O	—	—	100
SP.M.I	4	5	100
SP.M.O	0	—	100
UC.H	—	0	61
UC.H.ID	0	0	0
UC.L	3	8	8
UC.M	9	10	10
Shipment-Weighted Average *	4	6	60

Parentheses indicate negative (−) values. The entry "—" means not applicable because there is no change in the standard at certain TSLs.
* Weighted by shares of each product class in total projected shipments in 2027.

For walk-in refrigeration systems, DOE first considered TSL 3, which represents the max-tech efficiency levels. At this level, DOE expects that medium- and low-temperature dedicated condensing system equipment classes [93] would require larger condenser coils, variable capacity compressors, and electronically commutated variable-speed condenser fan motors. Additionally, low- and medium-temperature outdoor dedicated condensing system equipment classes would generally require self-regulating crank case heater controls with a temperature switch, and ambient subcooling circuits. DOE anticipates that low- and medium-temperature single-packaged dedicated system equipment classes would also require larger evaporator coils, variable speed evaporator fans, and thermal insulation up to 4 inches in thickness. DOE expects that lower-capacity low- and medium-temperature single-packaged dedicated condensing units would require propane compressors. DOE expects that high-temperature dedicated condensing system equipment classes would require the same design options as medium- and low-temperature dedicated condensing systems except for larger condensing coils and variable capacity compressors.[94] Additionally, DOE expects that high-temperature single-packaged dedicated condensing systems would require up to 1.5 inches of thermal insulation and would not require larger evaporator coils or variable speed evaporator fans.[95] DOE anticipates that lower-capacity low- and medium-temperature unit cooler equipment classes would require evaporator coils 4 rows deep at TSL 3. Finally, DOE anticipates that higher-capacity low- and medium-temperature unit cooler equipment classes and all high-temperature unit cooler equipment classes would require evaporator coils 5 rows deep at TSL 3.

TSL 3 would save an estimated 3.10 quads of energy, an amount DOE considers significant. Under TSL 3, the NPV of consumer benefit would be −$12.99 billion using a discount rate of 7 percent, and −$25.14 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 3 are 56.8 Mt of CO_2, 17.4 thousand tons of SO_2, 105.4 thousand tons of NO_X, 0.12 tons of Hg, 474.0 thousand tons of CH_4, and 0.6 thousand tons of N_2O. The estimated monetary value of the climate benefits from reduced GHG emissions (associated with the average SC–GHG at a 3-percent discount rate) at TSL 3 is $3.22 billion. The estimated monetary value of the health benefits from reduced SO_2 and NO_X emissions at TSL 3 is $2.63 billion using a 7-percent discount rate and $6.31 billion using a 3-percent discount rate.

Using a 7-percent discount rate for consumer benefits and costs, health benefits from reduced SO_2 and NO_X emissions, and the 3-percent discount rate case for climate benefits from reduced GHG emissions, the estimated total NPV at TSL 3 is −$7.15 billion. Using a 3-percent discount rate for all benefits and costs, the estimated total NPV at TSL 3 is −$15.61 billion. The estimated total NPV is provided for additional information, however DOE primarily relies upon the NPV of consumer benefits when determining whether a proposed standard level is economically justified.

At TSL 3, the average LCC impact ranges from a savings of −$15,792 for low-temperature outdoor dedicated condensing units to $1,306 for low-temperature unit coolers. The simple payback period ranges from 1.2 years for low-temperature unit coolers to an infinite payback period for low-temperature dedicated condensing units, medium-temperature dedicated condensing units, low- and medium-temperature indoor single-packaged dedicated systems, and nonducted high-temperature unit coolers. several equipment classes. The fraction of

[93] Dedicated condensing system equipment classes include dedicated condensing units, matched-pair refrigeration systems (consisting of a paired dedicated condensing unit and unit cooler) and single-packaged dedicated systems.

[94] As discussed in section IV.C.1.d, DOE did not consider larger condensing coils or variable capacity compressors for high-temperature dedicated condensing systems.

[95] As discussed in section IV.C.1.d of this document, DOE did not consider larger evaporator coils or off cycle variable speed evaporator fans for high-temperature single-packaged dedicated condensing systems and only considered improved thermal insulation up to 1.5 inches.

consumers experiencing a net LCC cost ranges from 0 percent for high-temperature ducted unit coolers and high-temperature indoor ducted single-packaged dedicated system to 100 percent for low-temperature indoor and outdoor dedicated condensing units, medium-temperature indoor dedicated condensing units, and low- and medium-temperature indoor and outdoor single-packaged dedicated systems.

At TSL 3, the projected change in INPV ranges from a decrease of $159.6 million to an increase of $56.2 million, which corresponds to a decrease of 32.6 percent and an increase of 11.5 percent, respectively. DOE estimates that industry must invest $94.6 million to redesign walk-in refrigeration systems and purchase new tooling to accommodate changes to the condensers and/or evaporators for most analyzed capacities and equipment classes.

Currently, DOE has no evidence of significant shipments meeting the max-tech levels. As such, all manufacturers would need to redesign their walk-in refrigeration system models to incorporate a range of design options to meet TSL 3 efficiencies. Capital conversion costs are driven by incorporating design options such as larger condenser coils, improved evaporator coils, and/or ambient subcooling circuits, which would likely necessitate new tooling for updated baseplate designs across the full range of refrigeration system capacities and equipment classes. Implementing these design options would also require notable engineering resources and testing time, as manufacturers redesign models and potentially increase the footprint of refrigeration systems to accommodate larger condensers and/or evaporators.

Manufacturers would also need to qualify, source, and test new high-efficiency components. For medium- and low-temperature dedicated condensing system equipment classes that would likely require variable capacity compressors to meet the max-tech levels, manufacturers could face challenges sourcing variable capacity compressors across their portfolio of capacity offerings since the availability of variable capacity compressors for walk-in applications is limited. At the time of this NOPR publication, the few variable capacity compressor product lines DOE identified are not advertised for the North American market. Additionally, the identified product lines may not have a sufficient range of available compressor capacities to replace compressors in all walk-in applications.

The Secretary tentatively concludes that at TSL 3 for walk-in refrigeration systems, the benefits of energy savings, emissions reductions, and the estimated monetary value of the emissions reductions would be outweighed by the economic burden on many consumers in the form of negative NPV of consumer benefits, and the impacts on manufacturers, including the large conversion costs, and profit margin impacts that could result in a large reduction in INPV. Most low- and medium-temperature dedicated condensing system and single-packaged dedicated system consumers (ranging from 96 to 100 percent) would experience a net cost and the average LCC savings would be negative. At this level, there is risk of greater reduction in INPV at max-tech if manufacturers maintain their operating profit in the presence of amended efficiency standards on account of having higher costs but similar profits. Most manufacturers would need to dedicate notable capital and engineering resources to incorporate all analyzed design options across their entire range of equipment classes and capacity offerings. Furthermore, manufacturers may face challenges sourcing variable capacity compressors given the limited availability of variable capacity compressor product lines designed for walk-in applications. Consequently, the Secretary has tentatively concluded that TSL 3 is not economically justified.

DOE then considered TSL 2 for walk-in refrigeration systems. DOE expects that for medium- and low-temperature dedicated condensing systems, TSL 2 would not include variable capacity compressors.

DOE expects that at TSL 2, low-temperature and indoor medium-temperature dedicated condensing system equipment classes would generally require larger condenser coils; low- and medium-temperature outdoor dedicated condensing system equipment classes would also generally require self-regulating crank case heater controls with a temperature switch; additionally, low-temperature outdoor dedicated condensing system equipment classes would generally require electronically commutated variable-speed condenser fan motors and may require ambient subcooling circuits; low- and medium-temperature single-packaged dedicated system equipment classes would generally require larger evaporator coils and variable speed evaporator fans; low-temperature single-packaged dedicated system equipment classes would generally require thermal insulation up to 4 inches in thickness; lower-capacity low- and medium-temperature single-packaged dedicated condensing units would generally require propane compressors; high-temperature indoor dedicated condensing system equipment classes would generally incorporate max-tech design options; and high-temperature outdoor dedicated condensing system equipment classes would generally require self-regulating crank case heater controls with a temperature switch, thermal insulation up to 1.5 inches in thickness, and electronically commutated variable speed condenser fans. DOE expects that at TSL 2 all unit cooler equipment classes would incorporate the max-tech design options, except for high-temperature non-ducted unit coolers, which would generally require evaporator coils 4 rows deep at TSL 2.

TSL 2 would save an estimated 0.91 quads of energy, an amount DOE considers significant. Under TSL 2, the NPV of consumer benefit would be $0.68 billion using a discount rate of 7 percent, and $1.62 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 2 are 16.7 Mt of CO_2, 5.1 thousand tons of SO_2, 31.1 thousand tons of NO_X, 0.04 tons of Hg, 139.8 thousand tons of CH_4, and 0.2 thousand tons of N_2O. The estimated monetary value of the climate benefits from reduced GHG emissions (associated with the average SC–GHG at a 3-percent discount rate) at TSL 2 is $.95 billion. The estimated monetary value of the health benefits from reduced SO_2 and NO_X emissions at TSL 2 is $0.77 billion using a 7-percent discount rate and $1.68 billion using a 3-percent discount rate.

Using a 7-percent discount rate for consumer benefits and costs, health benefits from reduced SO_2 and NO_X emissions, and the 3-percent discount rate case for climate benefits from reduced GHG emissions, the estimated total NPV at TSL 2 is $2.41 billion. Using a 3-percent discount rate for all benefits and costs, the estimated total NPV at TSL 6 is $4.44 billion. The estimated total NPV is provided for additional information, however DOE primarily relies upon the NPV of consumer benefits when determining whether a proposed standard level is economically justified.

At TSL 2, the average LCC impact ranges from a savings of $103 for medium-temperature indoor single-packaged dedicated systems to $1,306 for low-temperature non-ducted unit coolers. The simple payback period ranges from 0.0 years for low-temperature outdoor single-packaged dedicated systems to 4.0 years for low-temperature indoor dedicated condensing units. The fraction of consumers experiencing a net LCC cost ranges from 0 percent for high-temperature indoor ducted single-packaged dedicated systems and high-temperature unit coolers to 11 percent for low-temperature indoor single-packaged dedicated systems.

At TSL 2, the projected change in INPV ranges from a decrease of $47.8 million to a decrease of $37.9 million, which corresponds to decreases of 9.8 percent and 7.7 percent, respectively. DOE estimates that industry must invest $60.1 million to redesign walk-in refrigeration systems and purchase some new tooling to accommodate changes to the condensers and/or evaporators for select capacities and equipment classes. At this level, DOE expects manufacturers could reach the TSL 2 efficiencies without implementing all the max-tech design options. Specifically, only some analyzed dedicated condensing system representative units would have to incorporate larger condenser coils or ambient subcooling, reducing the expected capital and product conversion costs at this level (*i.e.,* DC.L.O.009, DC.L.O.075, and all DC.M.O representative units would not require larger condensers or ambient subcooling, which together account for approximately 31 percent of industry refrigeration system unit shipments). Additionally, at this level, DOE does not expect manufacturers would need to implement variable capacity compressors, further reducing industry product conversion costs as compared to TSL 3.

After considering the analysis and weighing the benefits and burdens, the Secretary has tentatively concluded that a standard set at TSL 2 for refrigeration systems would be economically justified. At this TSL, the average LCC savings for all refrigeration equipment is positive. The consumers of low-temperature indoor single-packaged dedicated systems will be most affected with 11 percent of consumers experiencing a net cost, the consumers of the remaining equipment are estimated to experience a net cost between 0 and 10 percent of the time. The FFC national energy savings are significant and the NPV of consumer benefits is positive using both a 3-percent and 7-percent discount rate. Notably, the benefits to consumers vastly outweigh the cost to manufacturers. At TSL 2, the NPV of consumer benefits, even measured at the more conservative discount rate of 7 percent is over 33 times higher than the maximum estimated manufacturers' loss in INPV. The standard levels at TSL 2 are economically justified even without weighing the estimated monetary value of emissions reductions. When those emissions reductions are included—representing $0.95 billion in climate benefits (associated with the average SC–GHG at a 3-percent discount rate), and $1.86 billion (using a 3-percent discount rate) or $0.77 billion (using a 7-percent discount rate) in health benefits—the rationale for setting standards at TSL 2 for walk-in refrigeration systems is further strengthened.

Therefore, based on the previous considerations, DOE proposes to adopt energy conservation standards for walk-in refrigeration systems at TSL 2. The proposed amended energy conservation standards for walk-in refrigeration systems, which are expressed as AWEF2, are shown in Table V.99.

TABLE V.99—PROPOSED AMENDED ENERGY CONSERVATION STANDARDS FOR WALK-IN REFRIGERATION SYSTEMS

Equipment class	Minimum AWEF2 (Btu/W-h) *
Dedicated Condensing System—High, Indoor, Non-Ducted with a Net Capacity (q_{net}) of:	
<7000 Btu/h	$7.80E–04 \times q_{net} + 2.20$
≥7000 Btu/h	7.66
Dedicated Condensing system—High, Outdoor, Non-Ducted with a Net Capacity (q_{net}) of:	
<7000 Btu/h	$1.02E–03 \times q_{net} + 2.47$
≥7000 Btu/h	9.62
Dedicated Condensing system—High, Indoor, Ducted with a Net Capacity (q_{net}) of:	
<7000 Btu/h	$2.46E–04 \times q_{net} + 1.55$
≥7000 Btu/h	3.27
Dedicated Condensing system—High, Outdoor, Ducted with a Net Capacity (q_{net}) of:	
<7000 Btu/h	$3.76E–04 \times q_{net} + 1.78$
≥7000 Btu/h	4.41
Dedicated Condensing unit and Matched Refrigeration System—Medium, Indoor with a Net Capacity (q_{net}) of:	
<8000 Btu/h	5.58
≥8000 Btu/h and <25000 Btu/h	$3.00E–05 \times q_{net} + 5.34$
≥25000 Btu/h	6.09
Dedicated Condensing unit and Matched Refrigeration System—Medium, Outdoor with a Net Capacity (q_{net}) of:	
<25000 Btu/h	$2.13E–05 \times q_{net} + 7.15$
≥25000 Btu/h	7.68
Dedicated Condensing unit and Matched Refrigeration System—Low, Indoor with a Net Capacity (q_{net}) of:	
<25000 Btu/h	$2.50E–05 \times q_{net} + 2.36$
≥25000 Btu/h and <54000 Btu/h	$1.72E–06 \times q_{net} + 2.94$
≥54000 Btu/h	3.03
Dedicated Condensing unit and Matched Refrigeration System—Low, Outdoor with a Net Capacity (q_{net}) of:	
<9000 Btu/h	$9.83E–05 \times q_{net} + 2.63$
≥9000 Btu/h and <25000 Btu/h	$3.06E–05 \times q_{net} + 3.23$
≥25000 Btu/h and <75000 Btu/h	$4.96E–06 \times q_{net} + 3.88$
≥75000 Btu/h	4.25
Single-Packaged Dedicated Condensing system—Medium, Indoor with a Net Capacity (q_{net}) of:	
<9000 Btu/h	$9.86E–05 \times q_{net} + 4.91$
≥9000 Btu/h	5.8
Single-Packaged Dedicated Condensing system—Medium, Outdoor with a Net Capacity (q_{net}) of:	
<9000 Btu/h	$2.47E–04 \times q_{net} + 4.89$
≥9000 Btu/h	7.11
Single-Packaged Dedicated Condensing system—Low, Indoor with a Net Capacity (q_{net}) of:	
<6000 Btu/h	$8.00E–05 \times q_{net} + 1.8$

TABLE V.99—PROPOSED AMENDED ENERGY CONSERVATION STANDARDS FOR WALK-IN REFRIGERATION SYSTEMS—Continued

Equipment class	Minimum AWEF2 (Btu/W-h) *
≥6000 Btu/h	2.28
Single-Packaged Dedicated Condensing system—Low, Outdoor with a Net Capacity (q_{net}) of:	
<6000 Btu/h	1.63E–04 × q_{net} + 1.8
≥6000 Btu/h	2.77
Unit Cooler—High Non-Ducted with a Net Capacity (q_{net}) of:	
<9000 Btu/h	10.34
≥9000 Btu/h and <25000 Btu/h	3.83E–04 × q_{net} + 6.9
≥25000 Btu/h	16.46
Unit Cooler—High Ducted with a Net Capacity (q_{net}) of:	
<9000 Btu/h	6.93
≥9000 Btu/h and <25000 Btu/h	3.64E–04 × q_{net} + 3.66
≥25000 Btu/h	12.76
Unit Cooler—Medium	9.65
Unit Cooler—Low	4.57

* Where q_{net} is net capacity as determined in accordance with § 431.304 and certified in accordance with 10 CFR part 429.

2. Annualized Benefits and Costs of the Proposed Standards

The benefits and costs of the proposed standards can also be expressed in terms of annualized values. The annualized net benefit is (1) the annualized national economic value (expressed in 2022$) of the benefits from operating products that meet the proposed standards (consisting primarily of operating cost savings from using less energy, minus increases in product purchase costs, and (2) the annualized monetary value of the climate and health benefits from emission reductions.

Table V.100 shows the annualized values for walk-in non-display doors and refrigeration systems under TSL 2, expressed in 2022$. The results under the primary estimate are as follows.

Using a 7-percent discount rate for consumer benefits and costs and health benefits from reduced NO_X and SO_2 emissions, and the 3-percent discount rate case for climate benefits from reduced GHG emissions, the estimated cost of the standards proposed in this rule is $126.4 million per year in increased equipment costs, while the estimated annual benefits are $280.6 million in reduced equipment operating costs, $190.1 million in climate benefits, and $245.6 million in health benefits. In this case. The net benefit would amount to $589.8 million per year.

Using a 3-percent discount rate for all benefits and costs, the estimated cost of the proposed standards is $129.6 million per year in increased equipment costs, while the estimated annual benefits are $338.6 million in reduced operating costs, $190.1 million in climate benefits, and $331.3 million in health benefits. In this case, the net benefit would amount to $730.5 million per year.

TABLE V.100—ANNUALIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR WALK-INS
[TSL 2]

	Million 2022$/year		
	Primary estimate	Low-net-benefits estimate	High-net-benefits estimate
3% discount rate			
Consumer Operating Cost Savings	260.0	265.3	264.9
Climate Benefits *	90.4	92.6	90.0
Health Benefits **	177.7	182.1	177.0
Total Monetized Benefits †	528.1	540.0	531.9
Consumer Incremental Product Costs ‡	72.4	102.6	64.7
Monetized Net Benefits	455.7	437.4	467.2
Change in Producer Cashflow (INPV ‡‡)	(7.6)–(5.4)	(7.6)–(5.4)	(7.6)–(5.4)
7% discount rate			
Consumer Operating Cost Savings	214.1	218.8	218.3
Climate Benefits * (3% discount rate)	90.4	92.6	90.0
Health Benefits **	132.2	135.3	131.7
Total Monetized Benefits †	436.7	446.7	440.0
Consumer Incremental Product Costs ‡	70.7	95.4	64.1
Monetized Net Benefits	366.0	351.2	376.0
Change in Producer Cashflow (INPV ‡‡)	(7.6)–(5.4)	(7.6)–(5.4)	(7.6)–(5.4)

Note: This table presents the costs and benefits associated with walk-in coolers and freezers shipped in 2027–2056. These results include benefits to consumers which accrue after 2056 from the products shipped in 2027–2056.

* Climate benefits are calculated using four different estimates of the social cost of carbon (SC–CO_2), methane (SC–CH_4), and nitrous oxide (SC–N_2O) (model average at 2.5 percent, 3 percent, and 5 percent discount rates; 95th percentile at 3 percent discount rate) (see section IV.L of this document). Together these represent the global SC–GHG. For presentational purposes of this table, the climate benefits associated with the average SC–GHG at a 3 percent discount rate are shown; however, DOE emphasizes the importance and value of considering the benefits calculated using all four sets of SC–GHG estimates. To monetize the benefits of reducing GHG emissions, this analysis uses the interim estimates presented in the *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990* published in February 2021 by the IWG.

** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. DOE is currently only monetizing (for SO_2 and NO_X) $PM_{2.5}$ precursor health benefits and (for NO_X) ozone precursor health benefits, but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions. See section IV.L of this document for more details.

† Total and net benefits include those consumer, climate, and health benefits that can be quantified and monetized. For presentation purposes, total and net benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate.

‡ Costs include incremental equipment costs as well as installation costs.

‡‡ Operating Cost Savings are calculated based on the life cycle costs analysis and national impact analysis as discussed in detail. See sections IV.F and IV.H document. DOE's NIA includes all impacts (both costs and benefits) along the distribution chain beginning with the increased costs to the manufacturer to manufacture the product and ending with the increase in price experienced by the consumer. DOE also separately conducts a detailed analysis on the impacts on manufacturers (the MIA). See section IV.J of this document. In the detailed MIA, DOE models manufacturers' pricing decisions based on assumptions regarding investments, conversion costs, cashflow, and margins. The MIA produces a range of impacts, which is the rule's expected impact on the INPV. The change in INPV is the present value of all changes in industry cash flow, including changes in production costs, capital expenditures, and manufacturer profit margins. The annualized change in INPV is calculated using the industry weighted average cost of capital values of 9.4 percent for walk-in non-display doors and 10.2 percent for walk-in refrigeration systems that are estimated in the manufacturer impact analysis (see chapter 12 of the NOPR TSD for a complete description of the industry weighted average cost of capital). For walk-ins, those values are −$7.6 million to −$5.4 million. DOE accounts for that range of likely impacts in analyzing whether a TSL is economically justified. See section V.C of this document. DOE is presenting the range of impacts to the INPV under two markup scenarios: the Preservation of Gross Margin scenario, which is the manufacturer markup scenario used in the calculation of Consumer Operating Cost Savings in this table, and the Preservation of Operating Profit Markup scenario, where DOE assumed manufacturers would not be able to increase per-unit operating profit in proportion to increases in manufacturer production costs. DOE includes the range of estimated annualized change in INPV in the above table, drawing on the MIA explained further in section IV.J of this document, to provide additional context for assessing the estimated impacts of this proposal to society, including potential changes in production and consumption, which is consistent with OMB's Circular A–4 and E.O. 12866. If DOE were to include the INPV into the annualized net benefit calculation for this proposed rule, the annualized net benefits would range from $448.1 million to $450.3 million at 3-percent discount rate and would range from $358.4 million to $360.6 million at 7-percent discount rate. Parentheses () indicate negative values. DOE seeks comment on this approach.

D. Reporting, Certification, and Sampling Plan

Manufacturers, including importers, must use product-specific certification templates to certify compliance to DOE. For walk-in coolers and freezers, the certification template reflects the general certification requirements specified at 10 CFR 429.12 and the product-specific requirements specified at 10 CFR 429.53. As discussed in the previous paragraphs, DOE is not proposing to amend the product-specific certification requirements for this equipment in this proposed rulemaking.

VI. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866, 13563, and 14094

Executive Order (''E.O.'') 12866, ''Regulatory Planning and Review,'' as supplemented and reaffirmed by E.O. 13563, ''Improving Regulation and Regulatory Review,'' 76 FR 3821 (Jan. 21, 2011) and amended by E.O. 14094, ''Modernizing Regulatory Review,'' 88 FR 21879 (April 11, 2023), requires agencies, to the extent permitted by law, to (1) propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public. DOE emphasizes as well that E.O. 13563 requires agencies to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible. In its guidance, the Office of Information and Regulatory Affairs (''OIRA'') in the Office of Management and Budget (''OMB'') has emphasized that such techniques may include identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes. For the reasons stated in the preamble, this proposed regulatory action is consistent with these principles.

Section 6(a) of E.O. 12866 also requires agencies to submit ''significant regulatory actions'' to OIRA for review. OIRA has determined that this final regulatory action constitutes a ''significant regulatory action'' within the scope of section 3(f)(1) of E.O. 12866. Accordingly, pursuant to section 6(a)(3)(C) of E.O. 12866, DOE has provided to OIRA an assessment, including the underlying analysis, of benefits and costs anticipated from the final regulatory action, together with, to the extent feasible, a quantification of those costs; and an assessment, including the underlying analysis, of costs and benefits of potentially effective and reasonably feasible alternatives to the planned regulation, and an explanation why the planned regulatory action is preferable to the identified potential alternatives. These assessments are summarized in this preamble and further detail can be found in the technical support document for this rulemaking.

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of an initial regulatory flexibility analysis (''IRFA'') for any rule that by law must be proposed for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by E.O. 13272, ''Proper Consideration of Small Entities in Agency Rulemaking,'' 67 FR 53461 (Aug. 16, 2002), DOE published procedures and policies on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel's website (*energy.gov/gc/office-general-counsel*). DOE has prepared the following IRFA for the products that are the subject of this rulemaking.

For manufacturers of walk-ins, the 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. (See 13 CFR part 121.) The size standards are listed by North American Industry Classification System (''NAICS'') code and industry description and are available at *www.sba.gov/document/support--table-size-standards.* Manufacturing of walk-ins is classified under NAICS 333415, ''Air Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.'' The SBA sets a threshold of 1,250 employees or fewer for an entity to be considered as a small business for this category.

1. Description of Reasons Why Action Is Being Considered

DOE is proposing amended energy conservation standards for walk-ins. EPCA authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. Title III, Part C of EPCA, added by Public Law 95–619, Title IV, section 441(a) (42 U.S.C. 6311–6317, as codified), established the Energy Conservation Program for Certain Industrial Equipment, which sets forth a variety of provisions designed to improve energy efficiency. This equipment includes walk-ins, the subject of this document. (42 U.S.C. 6311(1)(G)) EPCA prescribed initial standards for these products. (42 U.S.C. 6313(f)(1)) EPCA provides that, not later than 6 years after the issuance of any final rule establishing or amending a standard, DOE must publish either a notice of determination that standards for the product do not need to be amended, or a NOPR including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6316(a); 42 U.S.C. 6295(m)(1))

DOE prescribed the energy conservation standards for walk-in doors, panels, and refrigeration systems manufactured on and after June 5, 2017 in a final rule published on June 3, 2014. 79 FR 32050. After publication of the June 2014 Final Rule, AHRI and Lennox International, Inc. (''Lennox''), a manufacturer of walk-in refrigeration systems, filed petitions for review of DOE's final rule and DOE's subsequent denial of a petition for reconsideration of the rule (79 FR 59090 (October 1, 2014)) with the United States Court of Appeals for the Fifth Circuit. *Lennox Int'l* v. *Dep't of Energy,* Case No. 14–60535 (5th Cir.). A settlement agreement was reached among the parties under which the Fifth Circuit vacated energy conservation standards for six of the refrigeration system equipment classes—the two standards applicable to multiplex condensing refrigeration systems (subsequently re-named as ''unit coolers'') operating at medium and low-temperatures and the four standards applicable to dedicated condensing refrigeration systems operating at low-temperatures.[96] After the Fifth Circuit issued its order, DOE established a Working Group to negotiate energy conservation standards to replace the six vacated standards. 80 FR 46521 (August 5, 2015). In a final rule published on July 10, 2017, DOE adopted energy conservation standards for the six classes of walk-in refrigeration systems were vacated—specifically, unit coolers and low-temperature dedicated condensing systems manufactured. 82 FR 31808. The rule required compliance with the six new standards on and after July 10, 2020. This rulemaking is in accordance with DOE's obligations under EPCA.

2. Objectives of, and Legal Basis for, Rule

EPCA authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. Title III, Part C of EPCA, added by Public Law 95–619, Title IV, section 441(a) (42 U.S.C. 6311–6317, as codified), established the Energy Conservation Program for Certain Industrial Equipment, which sets forth a variety of provisions designed to improve energy efficiency. This equipment includes walk-ins, the subject of this document. (42 U.S.C. 6311(1)(G)) EPCA prescribed initial standards for these products. EPCA further provides that, not later than 6 years after the issuance of any final rule establishing or amending a standard, DOE must publish either a notice of determination that standards for the product do not need to be amended, or a NOPR including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6316(a); 42 U.S.C. 6295(m)(1))

3. Description on Estimated Number of Small Entities Regulated

DOE conducted a market survey using public information and subscription-based company reports to identify potential small manufacturers. DOE constructed databases of walk-in doors, panels, and refrigeration systems based on its review of models listed in DOE's Compliance Certification Database (CCD),[97] and supplemented the information in CCD with information from the California Energy Commission's Modernized Appliance Efficiency Database System (for refrigeration systems),[98] individual company websites, and prior walk-in rulemakings (79 FR 32050) to create a comprehensive database of walk-in components available on the U.S. market and their characteristics. DOE examined this database to identify companies that manufacture, produce, import, or assemble the equipment covered by this rulemaking. DOE then consulted publicly available data, such as manufacturer websites, manufacturer specifications and product literature, import/export logs (*e.g.,* bills of lading from Panjiva[99]), and basic model numbers, to identify original equipment manufacturers (OEMs) of walk-in doors, panels, and refrigeration systems. DOE further relied on public data and subscription-based market research tools (*e.g.,* Dun & Bradstreet reports[100]) to determine company, location, headcount, and annual revenue. DOE screened out companies that do not offer equipment covered by this rulemaking, do not meet the SBA's definition of a ''small business,'' or are foreign-owned and operated.

Using these data sources, DOE identified 79 original equipment manufacturers (OEMs) of WICFs that could be potentially affected by this rulemaking. Of these 79 OEMs, 58 are small, domestic manufacturers. DOE notes that some manufacturers may produce more than one of the principal components of WICFs: doors, panels,

[96] The 13 other standards established in the June 2014 Final Rule (*i.e.,* the four standards applicable to dedicated condensing refrigeration systems operating at medium temperatures; the three standards applicable to panels; and the six standards applicable to doors) were not vacated. The compliance date for the remaining standards was on or after June 5, 2017.

[97] U.S. Department of Energy's Compliance Certification Database is available at: *www.regulations.doe.gov/certification-data/#q=Product_Group_s%3A** (Last accessed January 27, 2023).

[98] California Energy Commission's Modernized Appliance Efficiency Database System is available at: *cacertappliances.energy.ca.gov/Pages/Search/AdvancedSearch.aspx.* (Last accessed January 27, 2023.)

[99] S&P Global. Panjiva Market Intelligence is available at: *panjiva.com/import-export/United-States* (Last accessed April 11, 2023).

[100] The Dun & Bradstreet Hoovers subscription login is available at *app.dnbhoovers.com.* (Last accessed April 11, 2023).

and refrigeration systems. Forty-four of the small, domestic OEMs manufacture doors; 38 of the small, domestic OEMs manufacture panels; and 14 of the small, domestic OEMs manufacture refrigeration systems.

4. Description and Estimate of Compliance Requirements Including Differences in Cost, if Any, for Different Groups of Small Entities

a. Doors

In this NOPR, DOE is proposing not to amend energy conservation standards for walk-in display doors. Walk-in display doors would remain at the current DOE minimum efficiency. Manufacturers, including small business manufacturers, would not need to make additional investments for walk-in display doors to comply with the proposed standard levels.

In this NOPR, DOE is proposing to amend energy conservation standards for walk-in non-display doors. Of the 44 small, domestic OEMs of walk-in doors, 40 manufacture non-display doors. At TSL 2, DOE expects manufacturers would need to update all non-display door designs to incorporate anti-sweat heater controls, improved door frame designs, and reduced anti-sweat heat. DOE does not expect manufacturers would need to increase insulation thickness to meet the efficiency levels required by the proposed level. However, manufacturers may need to invest in improved frame designs, which are most commonly made of polyurethane foam. Capital conversion costs are investments in property, plant, and equipment necessary to adapt or change existing production facilities such that new compliant equipment designs can be fabricated and assembled. Product conversion costs are investments in research, development, testing, marketing, and other non-capitalized costs necessary to make equipment designs comply with amended energy conservation standards. For the purposes of this IRFA, DOE assumed that the industry capital and product conversion costs would be evenly distributed across the 43 walk-in non-display door OEMs to avoid underestimating the potential capital and R&D investments small manufacturers may incur as a result of the proposed standard. DOE's investment estimates are based on results from the equipment teardown analysis, which assumed an average, representative production volume and feedback from higher volume manufacturers in confidential interviews. However, many of the small manufacturers have lower production volumes and require less production capacity (*e.g.,* fewer foam fixtures).

Therefore, DOE estimates that the 38 small businesses that only manufacture swinging non-display doors (*i.e.,* NM.L, NM.M) may each incur $0.6 million in capital and product conversion costs and that the two small businesses that also manufacture motorized doors (*i.e.,* NO.L, NO.M), may each incur conversion costs of approximately $1.2 million to meet the efficiencies required at TSL 2. Based on market research tools (*e.g.,* Dun & Bradstreet reports), DOE estimates that the annual revenue of small, domestic walk-in non-display door OEMs range from approximately $1.8 million to approximately $276.8 million, with an average annual revenue of $32.6 million. Conversion costs range from $0.6 million to $1.2 million, with average per OEM conversion costs of $0.6 million, which are approximately 2.9 percent of company revenue, on average, over the 3-year conversion period. See Table VI.1 for additional details. See section IV.J.2.c of the document and chapter 12 of the NOPR TSD for additional information on the conversion cost methodology and estimates.

TABLE VI.1—POTENTIAL SMALL BUSINESS IMPACTS: WALK-IN NON-DISPLAY DOORS

Number of small, domestic OEMs	Range of estimated annual revenue ($ millions)	Average per OEM conversion costs ($ millions)	Average conversion costs as a % of conversion period revenue
11	<=5.0	0.6	7.3
10	>5.0 and <=15.0	0.6	2.3
11	>15.0 and <=30.0	0.7	0.9
8	>30.0	0.7	0.3

DOE seeks comments, information, and data on the number of small businesses in the walk-in display and non-display door market, the names of those small businesses, and their market shares by equipment class. DOE also requests comment on the potential impacts of the proposed standards on small walk-in display and non-display door manufacturers.

b. Panels

In this NOPR, DOE is proposing not to amend energy conservation standards for walk-in panels. Therefore, DOE does not expect that manufacturers of walk-in panels, including small business manufacturers, would be directly impacted by the efficiency levels proposed in this NOPR as the levels would remain at the current DOE minimum efficiency.

DOE seeks comments, information, and data on the number of small businesses in the walk-in panel industry, the names of those small businesses, and their market shares by equipment class. DOE also requests comment on the potential impacts of the proposed standards on small walk-in panel manufacturers.

c. Refrigeration Systems

In this NOPR, DOE is proposing to amend energy conservation standards for walk-in refrigeration systems. At TSL 2, DOE expects some manufacturers of low-temperature and indoor medium-temperature dedicated condensing system equipment classes would generally need to incorporate larger condenser coils and/or ambient subcooling circuits; manufacturers of low- and medium-temperature outdoor dedicated condensing system equipment classes would also generally need to incorporate self-regulating crank case heater controls with a temperature switch; additionally, low-temperature outdoor dedicated condensing system equipment classes would generally require electronically commutated variable-speed condenser fan motors and may require ambient subcooling circuits; manufacturers of low- and medium-temperature single-packaged dedicated system equipment classes would generally need to incorporate larger evaporator coils and variable-speed evaporator fans; manufacturers of low-temperature single-packaged dedicated system equipment classes would also generally require thermal insulation up to 4 inches in thickness; manufacturers of lower-capacity low- and medium-temperature single-packaged dedicated condensing units would generally need to incorporate propane compressors; manufacturers of high-temperature indoor dedicated condensing system equipment classes would generally have to incorporate max-tech design options; and manufacturers of high-temperature outdoor dedicated condensing system equipment classes would generally have to incorporate self-regulating crank case heater controls with a temperature switch, thermal insulation up to 1.5 inches in thickness, and electronically commutated variable speed condenser fans. DOE expects that at TSL 2 all unit cooler equipment classes would incorporate the max-tech design options, except for high-temperature non-ducted unit coolers, which would generally require evaporator coils 4 rows deep at TSL 2.

Of the 14 small, domestic OEMs of walk-in refrigeration systems, five OEMs only manufacture high-temperature units (*i.e.,* SP.H.I, SP.H.ID, SP.H.O, SP.H.OD, UC.H, and/or UC.H.ID), three OEMs only manufacture low- and medium temperature dedicated condensing systems, two OEMs only manufacture low- and medium temperature unit coolers, and the remaining four OEMs manufacture low and medium temperature dedicated condensing systems and unit coolers.

For the five high-temperature OEMs, at TSL 2, DOE does not expect these small manufacturers would incur any capital conversion costs. Based on information gathered during manufacturer interviews, DOE understands that manufacturers of high-temperature units typically purchase the heat exchangers used for walk-in systems and would therefore not incur any capital conversion costs as a direct result of the proposed rule. For the remaining nine small, domestic OEMs of dedicated condensing systems and/or unit coolers, manufacturers would need to invest in new tooling to accommodate larger condenser coils, ambient subcooling, and/or larger evaporator coils. For the purposes of this IRFA, DOE assumed that the industry capital and product conversion costs for each equipment class would be evenly distributed across the OEMs that manufacture those equipment classes to avoid underestimating the potential capital and R&D investments small manufacturers may incur as a result of the proposed standard. DOE believes this conservative approach represents an upper bound of potential small business investments. DOE's investment estimates are based on results from the equipment teardown analysis, which assumed an average, representative production volume and array of capacity offerings. However, small manufacturers have lower production volumes and require less production capacity (*e.g.,* lower tooling costs).

Based on market research tools (*e.g.,* Dun & Bradstreet reports), DOE estimates that annual revenue of small, domestic walk-in refrigeration system OEMs range from approximately $3.7 million to approximately $276.8 million, with an average annual revenue of $74.9 million. The conversion costs range from $0.3 million to $3.8 million, with average per OEM conversion costs of $1.8 million, which are approximately 2.6 percent of company revenue, on average, over the 3-year conversion period. See Table VI.2 for additional details.

TABLE VI.2—POTENTIAL SMALL BUSINESS IMPACTS: WALK-IN REFRIGERATION SYSTEMS

Company	Estimated capital conversion costs ($ millions)	Estimated product conversion costs ($ millions)	Estimated total conversion costs ($ millions)	Estimated annual revenue ($ millions)	Conversion costs as a % of conversion period revenue
Manufacturer 1	0.0	0.3	0.3	3.7	2.8
Manufacturer 2	0.0	0.3	0.3	3.9	2.6
Manufacturer 3	1.3	0.8	2.1	6.3	11.3
Manufacturer 4	0.0	0.3	0.3	8.9	1.2
Manufacturer 5	0.0	0.3	0.3	10.7	1.0
Manufacturer 6	1.3	0.8	2.1	11.4	6.3
Manufacturer 7	1.3	0.8	2.1	13.1	5.4
Manufacturer 8	0.8	0.7	1.5	33.8	1.5
Manufacturer 9	2.1	1.5	3.6	88.7	1.4
Manufacturer 10	2.1	1.7	3.8	110.3	1.1
Manufacturer 11	2.1	1.5	3.6	116.2	1.0
Manufacturer 12	2.1	1.7	3.8	156.3	0.8
Manufacturer 13	0.0	0.3	0.3	208	0.1
Manufacturer 14	0.8	0.7	1.5	276.8	0.2

DOE seeks comments, information, and data on the number of small businesses in the walk-in refrigeration system industry, the names of those small businesses, and their market shares by equipment class. DOE also requests comment on the potential impacts of the proposed standards on small walk-in refrigeration system manufacturers.

5. Duplication, Overlap, and Conflict With Other Rules and Regulations

DOE is not aware of any rules or regulations that duplicate, overlap, or conflict with the proposed rule.

6. Significant Alternatives to the Rule

The discussion in the previous section analyzes impacts on small businesses that would result from DOE's proposed rule, represented by TSL 2 for walk-in doors, panels, and refrigeration systems. In reviewing alternatives to the proposed rule, DOE examined energy conservation standards set at lower efficiency levels for walk-in non-display doors and refrigeration systems. While TSL 1 would reduce the impacts on small business manufacturers of walk-in non-display doors and refrigeration systems, it would come at the expense of a reduction in energy savings. For walk-in non-display doors, TSL 1 achieves 1.1 percent lower energy savings compared to the energy savings at TSL 2. For walk-in refrigeration systems, TSL 1 achieves 11.5 percent lower energy savings compared to the energy savings at TSL 2.

Based on the presented discussion, establishing standards at TSL 2 for walk-in non-display doors and refrigeration systems balances the benefits of the energy savings at TSL 2 with the potential burdens placed on walk-ins manufacturers, including small business manufacturers. Accordingly, DOE does not propose one of the other TSLs considered in the analysis, or the other policy alternatives examined as part of the regulatory impact analysis and included in chapter 17 of the NOPR TSD.

Additional compliance flexibilities may be available through other means. Manufacturers subject to DOE's energy efficiency standards may apply to DOE's Office of Hearings and Appeals for exception relief under certain circumstances. Manufacturers should refer to 10 CFR part 430, subpart E, and 10 CFR part 1003 for additional details.

C. Review Under the Paperwork Reduction Act

Under the procedures established by the Paperwork Reduction Act of 1995 (''PRA''), a person is not required to respond to a collection of information by a Federal agency unless that collection of information displays a currently valid OMB Control Number.

OMB Control Number 1910–1400, Compliance Statement Energy/Water Conservation Standards for Appliances, is currently valid and assigned to the certification reporting requirements applicable to covered equipment, including walk-in coolers and freezers.

DOE's certification and compliance activities ensure accurate and comprehensive information about the energy and water use characteristics of covered products and covered equipment sold in the United States. Manufacturers of all covered products and covered equipment must submit a certification report before a basic model is distributed in commerce, annually thereafter, and if the basic model is redesigned in such a manner to increase the consumption or decrease the efficiency of the basic model such that the certified rating is no longer supported by the test data. Additionally, manufacturers must report when production of a basic model has ceased and is no longer offered for sale as part of the next annual certification report following such cessation. DOE requires the manufacturer of any covered product or covered equipment to establish, maintain, and retain the records of certification reports, of the underlying test data for all certification testing, and of any other testing conducted to satisfy the requirements of part 429, part 430, and/or part 431. Certification reports provide DOE and consumers with comprehensive, up-to date efficiency information and support effective enforcement.

Revised certification data would be required for walk-in refrigeration systems were this NOPR to be finalized as proposed; however, DOE is not proposing amended certification or reporting requirements for walk-in refrigeration systems in this NOPR. Instead, DOE may consider proposals to establish certification requirements and reporting for walk-in refrigeration systems under a separate rulemaking regarding appliance and equipment certification. DOE will address changes to OMB Control Number 1910–1400 at that time, as necessary.

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the PRA, unless that collection of information displays a currently valid OMB Control Number.

Manufacturers of walk-in doors and panels must certify to DOE that their products comply with any applicable energy conservation standards. In certifying compliance, manufacturers must test their products according to the DOE test procedures for walk-ins, including any amendments adopted for those test procedures. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, including walk-ins. (See generally 10 CFR part 429). The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act (''PRA''). This requirement has been approved by OMB under OMB control number 1910–1400. Public reporting burden for the certification is estimated to average 35 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the PRA, unless that collection of information displays a currently valid OMB Control Number.

D. Review Under the National Environmental Policy Act of 1969

DOE is analyzing this proposed regulation in accordance with the National Environmental Policy Act of 1969 (''NEPA'') and DOE's NEPA implementing regulations (10 CFR part 1021). DOE's regulations include a categorical exclusion for rulemakings that establish energy conservation standards for consumer products or industrial equipment. 10 CFR part 1021, subpart D, appendix B5.1. DOE anticipates that this rulemaking qualifies for categorical exclusion B5.1 because it is a rulemaking that establishes energy conservation standards for consumer products or industrial equipment, none of the exceptions identified in categorical exclusion B5.1(b) apply, no extraordinary circumstances exist that require further environmental analysis, and it otherwise meets the requirements for application of a categorical exclusion. See 10 CFR 1021.410. DOE will complete its NEPA review before issuing the final rule.

E. Review Under Executive Order 13132

E.O. 13132, ''Federalism,'' 64 FR 43255 (Aug. 10, 1999), imposes certain requirements on Federal agencies formulating and implementing policies or regulations that preempt State law or that have federalism implications. The Executive order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE has examined this proposed rule and has tentatively determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the equipment that are the subject of this proposed rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (*See* 42 U.S.C. 6316(a) and (b); 42 U.S.C. 6297) Therefore, no further action is required by Executive Order 13132.

F. Review Under Executive Order 12988

With respect to the review of existing regulations and the promulgation of new regulations, section 3(a) of E.O. 12988, ''Civil Justice Reform,'' imposes on Federal agencies the general duty to adhere to the following requirements: (1) eliminate drafting errors and ambiguity, (2) write regulations to minimize litigation, (3) provide a clear legal standard for affected conduct rather than a general standard, and (4) promote simplification and burden reduction. 61 FR 4729 (Feb. 7, 1996). Regarding the review required by section 3(a), section 3(b) of E.O. 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation: (1) clearly specifies the preemptive effect, if any, (2) clearly specifies any effect on existing Federal law or regulation, (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction, (4) specifies the retroactive effect, if any, (5) adequately defines key terms, and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of Executive Order 12988 requires Executive agencies to review regulations in light of applicable standards in section 3(a) and section 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, this proposed rule meets the relevant standards of E.O. 12988.

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (''UMRA'') requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Public Law 104–4, section 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed ''significant intergovernmental mandate,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect them. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. DOE's policy statement is also available at *www.energy.gov/sites/prod/files/gcprod/documents/umra_97.pdf.*

This rule does not contain a Federal intergovernmental mandate, nor is it expected to require expenditures of $100 million or more in any one year by the private sector. As a result, the analytical requirements of UMRA do not apply.

H. Review Under the Treasury and General Government Appropriations Act, 1999

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

I. Review Under Executive Order 12630

Pursuant to E.O. 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights,'' 53 FR 8859 (Mar. 15, 1988), DOE has determined that this proposed rule would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

J. Review Under the Treasury and General Government Appropriations Act, 2001

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 note) provides for Federal agencies to review most disseminations of information to the public under information quality guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). Pursuant to OMB Memorandum M–19–15, Improving Implementation of the Information Quality Act (April 24, 2019), DOE published updated guidelines which are available at *www.energy.gov/sites/prod/files/2019/12/f70/DOE%20Final%20Updated%20IQA%20Guidelines%20Dec%202019.pdf.* DOE has reviewed this NOPR under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

K. Review Under Executive Order 13211

E.O. 13211, ''Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use,'' 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OIRA at OMB, a Statement of Energy Effects for any 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, 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 has tentatively concluded that this regulatory action, which proposes amended energy conservation standards for walk-ins, 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 on this proposed rule.

L. Information Quality

On December 16, 2004, OMB, in consultation with the Office of Science and Technology Policy (''OSTP''), issued its Final Information Quality Bulletin for Peer Review (''the Bulletin''). 70 FR 2664 (Jan. 14, 2005). The Bulletin establishes that certain scientific information shall be peer reviewed by qualified specialists before it is disseminated by the Federal Government, including influential scientific information related to agency regulatory actions. The purpose of the Bulletin is to enhance the quality and credibility of the Government's scientific information. Under the Bulletin, the energy conservation standards rulemaking analyses are ''influential scientific information,'' which the Bulletin defines as ''scientific information the agency reasonably can determine will have, or does have, a clear and substantial impact on important public policies or private sector decisions.'' 70 FR 2664, 2667.

In response to OMB's Bulletin, DOE conducted formal peer reviews of the energy conservation standards development process and the analyses that are typically used and has prepared a report describing that peer review.[101] Generation of this report involved a rigorous, formal, and documented evaluation using objective criteria and qualified and independent reviewers to make a judgment as to the technical/scientific/business merit, the actual or anticipated results, and the productivity and management effectiveness of programs and/or projects. Because available data, models, and technological understanding have changed since 2007, DOE has engaged with the National Academy of Sciences to review DOE's analytical methodologies to ascertain whether modifications are needed to improve the Department's analyses. DOE is in the process of evaluating the resulting report.[102]

VII. Public Participation

A. Participation in the Webinar

The time and date the webinar meeting are listed in the **DATES** section at the beginning of this document. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website: *https://www.energy.gov/eere/buildings/public-meetings-and-comment-deadlines.* Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Prepared General Statements for Distribution

Any person who has an interest in the topics addressed in this proposed rule, or who is representative of a group or class of persons that has an interest in these issues, may request an opportunity to make an oral presentation at the webinar. Such persons may submit to *ApplianceStandardsQuestions@ee.doe.gov.* Persons who wish to speak should include with their request a computer file in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format that briefly describes the nature of their interest in this rulemaking and the topics they wish to discuss. Such persons should also provide a daytime telephone number where they can be reached.

C. Conduct of the Webinar

DOE will designate a DOE official to preside at the webinar/public meeting and may also use a professional facilitator to aid discussion. The meeting will not be a judicial or evidentiary-type public hearing, but DOE will conduct it in accordance with section 336 of EPCA (42 U.S.C. 6306). A court reporter will be present to record the proceedings and prepare a transcript. DOE reserves the right to schedule the order of presentations and to establish the procedures governing the conduct of the webinar. There shall not be discussion of proprietary information, costs or prices, market share, or other commercial matters regulated by U.S. anti-trust laws. After the webinar and until the end of the comment period, interested parties may submit further comments on the proceedings and any aspect of the proposed rulemaking.

The webinar will be conducted in an informal, conference style. DOE will present a general overview of the topics addressed in this rulemaking, allow time for prepared general statements by participants, and encourage all interested parties to share their views on issues affecting this rulemaking. Each participant will be allowed to make a general statement (within time limits determined by DOE), before the discussion of specific topics. DOE will permit, as time permits, other participants to comment briefly on any general statements.

At the end of all prepared statements on a topic, DOE will permit participants to clarify their statements briefly. Participants should be prepared to answer questions by DOE and by other participants concerning these issues. DOE representatives may also ask questions of participants concerning other matters relevant to this rulemaking. The official conducting the webinar/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 webinar.

A transcript of the webinar will be included in the docket, which can be viewed as described in the *Docket* section at the beginning of this notice. 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, data, and other information using any of the methods described in the **ADDRESSES** section at the beginning of this document.

Submitting comments via www.regulations.gov. The *www.regulations.gov* web page will require you to provide your name and contact information. Your contact information will be viewable to DOE Building Technologies staff only. Your contact information will not be publicly viewable except for your first and last names, organization name (if any), and submitter representative name (if any). If your comment is not processed properly because of technical difficulties, DOE will use this information to contact you. If DOE cannot read your comment due to technical difficulties and cannot contact you for clarification, DOE may not be able to consider your comment.

However, your contact information will be publicly viewable if you include it in the comment itself or in any documents attached to your comment. Any information that you do not want to be publicly viewable should not be included in your comment, nor in any document attached to your comment. Otherwise, persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

Do not submit to *www.regulations.gov* information for which disclosure is restricted by statute, such as trade secrets and commercial or financial information (hereinafter referred to as Confidential Business Information (''CBI'')). Comments submitted through *www.regulations.gov* cannot be claimed as CBI. Comments received through the website will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section.

DOE processes submissions made through *www.regulations.gov* before posting. Normally, comments will be posted within a few days of being submitted. However, if large volumes of

[101] The 2007 ''Energy Conservation Standards Rulemaking Peer Review Report'' is available at the following website: *energy.gov/eere/buildings/downloads/energy-conservation-standards-rulemaking-peer-review-report-0* (last accessed April 17, 2023).

[102] The report is available at *www.nationalacademies.org/our-work/review-of-methods-for-setting-building-and-equipment-performance-standards.*

comments are being processed simultaneously, your comment may not be viewable for up to several weeks. Please keep the comment tracking number that *www.regulations.gov* provides after you have successfully uploaded your comment.

Submitting comments via email, hand delivery/courier, or postal mail. Comments and documents submitted via email, hand delivery/courier, or postal mail also will be posted to *www.regulations.gov.* If you do not want your personal contact information to be publicly viewable, do not include it in your comment or any accompanying documents. Instead, provide your contact information in a cover letter. Include your first and last names, email address, telephone number, and optional mailing address. The cover letter will not be publicly viewable as long as it does not include any comments.

Include contact information each time you submit comments, data, documents, and other information to DOE. If you submit via postal mail or hand delivery/courier, please provide all items on a CD, if feasible, in which case it is not necessary to submit printed copies. No telefacsimiles (''faxes'') will be accepted.

Comments, data, and other information submitted to DOE electronically should be provided in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format. Provide documents that are not secured, that are written in English, and that are free of any defects or viruses. Documents should not contain special characters or any form of encryption and, if possible, they should carry the electronic signature of the author.

Campaign form letters. Please submit campaign form letters by the originating organization in batches of between 50 to 500 form letters per PDF or as one form letter with a list of supporters' names compiled into one or more PDFs. This reduces comment processing and posting time.

Confidential Business Information. Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email two well-marked copies: one copy of the document marked ''confidential'' including all the information believed to be confidential, and one copy of the document marked ''non-confidential'' with the information believed to be confidential deleted. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

It is DOE's policy that all comments may be included in the public docket, without change and as received, including any personal information provided in the comments (except information deemed to be exempt from public disclosure).

E. Issues on Which DOE 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) DOE requests comment on the methodology used to present the change in producer cash flow (INPV) in the monetized benefits and costs tables in Table I.6, Table I.7, and Table V.100.

(2) DOE seeks comment on the baseline and assumed reduction in anti-sweat heater wire power listed in Table IV.10. DOE specifically seeks feedback on whether the reduced anti-sweat heater wire power is acceptable for use in walk-in doors at all climates and installations throughout the U.S.

(3) DOE requests test results or performance data for walk-in refrigeration systems using R–454A, R–454C, and/or R–455A. Additionally, DOE requests comment on its tentative determination that R–454A is the most likely replacement for R–448A and R–449A with a GWP of less than 300 and that walk-in dedicated condensing systems would not suffer a performance penalty when switching from R–448A or R–449A to R–454A.

(4) DOE requests comment on any potential low-GWP replacements for high-temperature systems. Additionally, DOE requests high-temperature performance data or test results for any potential low-GWP alternatives to R–134A.

(5) DOE seeks comment on e-commerce distribution channels, including which types of walk-in equipment use this channel and the size of this channel.

(6) DOE seeks comment on its assumptions and rationale for harmonizing panel and non-display door thicknesses at a given TSL.

(7) DOE seeks information and data from which to create representative distributions of run time hours for different walk-in refrigeration equipment and temperature classes.

(8) DOE requests any comment, data, and sources of information for the maintenance and repair costs of walk-in coolers and freezers with the technologies described in IV.C.

(9) DOE requests information or data to characterize a shift toward larger capacity equipment in its analysis. DOE seeks information about the represented units, customer types (food service, food sales, other), and business sizes effected.

(10) DOE requests comments on its assumption that there is no rebound effect for walk-in coolers and freezers.

(11) DOE requests comments on its subgroups analysis.

(12) DOE seeks comments, information, and data on the capital conversion costs and product conversion costs estimated for each efficiency level and TSL for walk-in display and non-display doors. See chapter 12 of the NOPR TSD for the estimated conversion costs for each analyzed efficiency level.

(13) DOE seeks comments, information, and data on the capital conversion costs and product conversion costs estimated for each efficiency level and TSL for walk-in panels. See chapter 12 of the NOPR TSD for the estimated conversion costs for each analyzed efficiency level.

(14) DOE seeks comments, information, and data on the capital conversion costs and product conversion costs estimated for each TSL for walk-in refrigeration systems.

(15) DOE seeks comment on whether manufacturers expect manufacturing capacity constraints would limit walk-in display and non-display door availability to consumers in the timeframe of the amended standard compliance date (2027).

(16) DOE seeks comment on whether manufacturers expect manufacturing capacity constraints would limit walk-in panel availability to consumers in the timeframe of the amended standard compliance date (2027).

(17) DOE seeks comment on whether manufacturers expect manufacturing capacity constraints or engineering resource constraints would limit walk-in refrigeration system availability to consumers in the timeframe of the amended standard compliance date (2027).

(18) DOE requests comments on the magnitude of costs associated with transitioning walk-in refrigeration systems and production facilities to accommodate low-GWP refrigerants that would be incurred between the publication of this NOPR and the proposed compliance date of amended standards. Quantification and categorization of these costs, such as engineering efforts, testing lab time, certification costs, and capital investments (*e.g.,* new charging equipment), would enable DOE to refine its analysis.

(19) DOE requests information regarding the impact of cumulative regulatory burden on manufacturers of walk-ins associated with multiple DOE

standards or product/equipment-specific regulatory actions of other Federal agencies.

(20) DOE seeks comments, information, and data on the number of small businesses in the walk-in display and non-display door market, the names of those small businesses, and their market shares by equipment class. DOE also requests comment on the potential impacts of the proposed standards on small walk-in display and non-display door manufacturers.

(21) DOE seeks comments, information, and data on the number of small businesses in the walk-in panel industry, the names of those small businesses, and their market shares by equipment class. DOE also requests comment on the potential impacts of the proposed standards on small walk-in panel manufacturers.

(22) DOE seeks comments, information, and data on the number of small businesses in the walk-in refrigeration system industry, the names of those small businesses, and their market shares by equipment class. DOE also requests comment on the potential impacts of the proposed standards on small walk-in refrigeration system manufacturers.

Additionally, DOE welcomes comments on other issues or data relevant to the conduct of this rulemaking that may not specifically be identified in this document.

VIII. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this notice of proposed rulemaking and announcement of public meeting.

List of Subjects in 10 CFR Part 431

Administrative practice and procedure, Confidential business information, Energy conservation test procedures, and Reporting and recordkeeping requirements.

Signing Authority

This document of the Department of Energy was signed on August 11, 2023, by Francisco Alejandro Moreno, Acting Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the **Federal Register**.

Signed in Washington, DC, on August 11, 2023.

Treena V. Garrett,

Federal Register Liaison Officer, U.S. Department of Energy.

For the reasons set forth in the preamble, DOE proposes to amend part 431 of chapter II, subchapter D, of title 10 of the Code of Federal Regulations, as set forth below:

PART 431—ENERGY EFFICIENCY PROGRAM FOR CERTAIN COMMERCIAL AND INDUSTRIAL EQUIPMENT

■ 1. The authority citation for part 431 continues to read as follows:

Authority: 42 U.S.C. 6291–6317; 28 U.S.C. 2461 note.

■ 2. Amend § 431.306 by revising paragraphs (d) and (e) to read as follows:

§ 431.306 Energy conservation standards and their effective dates.

* * * * *

(d) *Walk-in cooler and freezer non-display doors.*

All walk-in cooler and walk-in freezer non-display doors manufactured starting on June 5, 2017 and before [*date 3 years after the publication of the final rule*] must satisfy the following standards:

Equipment class	Equations for maximum energy consumption (kWh/day) *
Passage Door, Medium Temperature	$0.05 \times A_{nd} + 1.7$
Passage Door, Low Temperature	$0.14 \times A_{nd} + 4.8$
Freight Door, Medium Temperature	$0.04 \times A_{nd} + 1.9$
Freight Door, Low Temperature	$0.12 \times A_{nd} + 5.6$

* A_{nd} represents the surface area of the non-display door.

All walk-in cooler and walk-in freezer non-display doors manufactured starting on [*date 3 years after the publication of the final rule*], must satisfy the following standards:

Equipment class	Equations for maximum energy consumption (kWh/day) *
Non-Display Door, Manual, Medium Temperature	$0.01 \times A_{nd} + 0.25$
Non-Display Door, Manual, Low Temperature	$0.06 \times A_{nd} + 1.32$
Non-Display Door, Motorized, Medium Temperature	$0.01 \times A_{nd} + 0.39$
Non-Display Door, Motorized, Low Temperature	$0.05 \times A_{nd} + 1.56$

* A_{nd} represents the surface area of the non-display door.

(e) *Walk-in cooler refrigeration systems.*

All walk-in cooler and walk-in freezer refrigeration systems manufactured starting on the dates listed in the table and before [*date 3 years after the publication of the final rule*], except for walk-in process cooling refrigeration systems (as defined in § 431.302), must satisfy the following standards:

Equipment class	Minimum AWEF (Btu/W-h) *	Compliance date: equipment manufactured starting on . . .
Dedicated Condensing System—Medium, Indoor	5.61	June 5, 2017.
Dedicated Condensing System—Medium, Outdoor	7.60	
Dedicated Condensing System—Low, Indoor with a Net Capacity (q_{net}) of:		
<6,500 Btu/h	$9.091 \times 10^{-5} \times q_{net} + 1.81$	July 10, 2020.
≥6,500 Btu/h	2.40	
Dedicated Condensing System—Low, Outdoor with a Net Capacity (q_{net}) of:		
<6,500 Btu/h	$6.522 \times 10^{-5} \times q_{net} + 2.73$	
≥6,500 Btu/h	3.15	
Unit Cooler—Medium	9.00	
Unit Cooler—Low with a Net Capacity (q_{net}) of:		
<15,500 Btu/h	$1.575 \times 10^{-5} \times q_{net} + 3.91$	
≥15,500 Btu/h	4.15	

* Where q_{net} is net capacity as determined in accordance with § 431.304 and certified in accordance with 10 CFR part 429.

All walk-in cooler and walk-in freezer refrigeration systems manufactured starting on [*date 3 years after the publication of the final rule*], except for walk-in process cooling refrigeration systems (as defined in § 431.302), must satisfy the following standards:

Equipment class	Minimum AWEF2 (Btu/W-h) *
Dedicated Condensing System—High, Indoor, Non-Ducted with a Net Capacity (q_{net}) of:	
<7000 Btu/h	7.80E–04 × q_{net} + 2.20
≥7000 Btu/h	7.66
Dedicated Condensing system—High, Outdoor, Non-Ducted with a Net Capacity (q_{net}) of:	
<7000 Btu/h	1.02E–03 × q_{net} + 2.47
≥7000 Btu/h	9.62
Dedicated Condensing system—High, Indoor, Ducted with a Net Capacity (q_{net}) of:	
<7000 Btu/h	2.46E–04 × q_{net} + 1.55
≥7000 Btu/h	3.27
Dedicated Condensing system—High, Outdoor, Ducted with a Net Capacity (q_{net}) of:	
<7000 Btu/h	3.76E–04 × q_{net} + 1.78
≥7000 Btu/h	4.41
Dedicated Condensing unit and Matched Refrigeration System—Medium, Indoor with a Net Capacity (q_{net}) of:	
<8000 Btu/h	5.58
≥8000 Btu/h and <25000 Btu/h	3.00E–05 × q_{net} + 5.34
≥25000 Btu/h	6.09
Dedicated Condensing unit and Matched Refrigeration System—Medium, Outdoor with a Net Capacity (q_{net}) of:	
<25000 Btu/h	2.13E–05 × q_{net} + 7.15
≥25000 Btu/h	7.68
Dedicated Condensing unit and Matched Refrigeration System—Low, Indoor with a Net Capacity (q_{net}) of:	
<25000 Btu/h	2.50E–05 × q_{net} + 2.36
≥25000 Btu/h and <54000 Btu/h	1.72E–06 × q_{net} + 2.94
≥54000 Btu/h	3.03
Dedicated Condensing unit and Matched Refrigeration System—Low, Outdoor with a Net Capacity (q_{net}) of:	
<9000 Btu/h	9.83E–05 × q_{net} + 2.63
≥9000 Btu/h and <25000 Btu/h	3.06E–05 × q_{net} + 3.23
≥25000 Btu/h and <75000 Btu/h	4.96E–06 × q_{net} + 3.88
≥75000 Btu/h	4.25
Single-Packaged Dedicated Condensing system—Medium, Indoor with a Net Capacity (q_{net}) of:	
<9000 Btu/h	9.86E–05 × q_{net} + 4.91
≥9000 Btu/h	5.8
Single-Packaged Dedicated Condensing system—Medium, Outdoor with a Net Capacity (q_{net}) of:	
<9000 Btu/h	2.47E–04 × q_{net} + 4.89
≥9000 Btu/h	7.11
Single-Packaged Dedicated Condensing system—Low, Indoor with a Net Capacity (q_{net}) of:	
<6000 Btu/h	8.00E–05 × q_{net} + 1.8
≥6000 Btu/h	2.28
Single-Packaged Dedicated Condensing system—Low, Outdoor with a Net Capacity (q_{net}) of:	
<6000 Btu/h	1.63E–04 × q_{net} + 1.8
≥6000 Btu/h	2.77
Unit Cooler—High Non-Ducted with a Net Capacity (q_{net}) of:	
<9000 Btu/h	10.34
≥9000 Btu/h and <25000 Btu/h	3.83E–04 × q_{net} + 6.9
≥25000 Btu/h	16.46
Unit Cooler—High Ducted with a Net Capacity (q_{net}) of:	
<9000 Btu/h	6.93
≥9000 Btu/h and <25000 Btu/h	3.64E–04 × q_{net} + 3.66
≥25000 Btu/h	12.76
Unit Cooler—Medium	9.65

Equipment class	Minimum AWEF2 (Btu/W-h) *
Unit Cooler—Low	4.57

* Where q_{net} is net capacity as determined in accordance with § 431.304 and certified in accordance with 10 CFR part 429.

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