DEPARTMENT OF ENERGY

10 CFR Part 430

[EERE–2020–BT–STD–0039]

RIN 1904–AF00

Energy Conservation Program: Energy Conservation Standards for Miscellaneous Refrigeration Products

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

ACTION: Notice of proposed rulemaking; 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 miscellaneous refrigeration products. 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 miscellaneous refrigeration products, 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 May 30, 2023.

Meeting: DOE will hold a public meeting via webinar on Tuesday, May 2, 2023, from 1:00 p.m. to 4:00 p.m. See section IV, ''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 May 1, 2023.

ADDRESSES: Interested persons are encouraged to submit comments using the Federal Rulemaking Portal at *www.regulations.gov,* under by docket number EERE–2020–BT–STD–0039. Follow the instructions for submitting comments. Alternatively, interested persons may submit comments, identified by docket number EERE–2020–BT–STD–0039, by any of the following methods:

Email: MRP2020STD0039@ee.doe.gov. Include the docket number EERE–2020–BT–STD–0039 in the subject line of the message.

Postal Mail: Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, Mailstop EE–5B, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (202) 287–1445. If possible, please submit all items on a compact disc (''CD''), in which case it is not necessary to include printed copies.

Hand Delivery/Courier: Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, 950 L'Enfant Plaza SW, 6th Floor, Washington, DC 20024. Telephone: (202) 287–1445. If possible, please submit all items on a CD, in which case it is not necessary to include printed copies.

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-2020-BT-STD-0039.* 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 rule.

FOR FURTHER INFORMATION CONTACT: Mr. Lucas Adin, 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.*

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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 B [2] of EPCA, established the Energy Conservation Program for Consumer Products Other Than Automobiles. (42 U.S.C. 6291–6309) These products include miscellaneous refrigeration products (''MREFs''), 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. 6295(o)(2)(A)) Furthermore, the new or amended standard must result in a significant conservation of energy. (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. 6295(m))

In accordance with these and other statutory provisions discussed in this document, DOE proposes amended energy conservation standards for miscellaneous refrigeration products. The proposed standards, which are expressed in kWh/yr, are shown in Table I.1. These proposed standards, if adopted, would apply to all miscellaneous refrigeration products listed in Table I.1 manufactured in, or imported into, the United States starting on the date 5 years after the publication of the final rule for this rulemaking.

TABLE I.1—PROPOSED ENERGY CONSERVATION STANDARDS FOR MISCELLANEOUS REFRIGERATION PRODUCTS

Product class	Equations for maximum energy use (kWh/yr)
1. Freestanding compact coolers (''FCC'')	5.52AV + 109.1
2. Freestanding coolers (''FC'')	5.52AV + 109.1
3. Built-in compact coolers (''BICC'')	5.52AV + 109.1

[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 B was redesignated Part A.

TABLE I.1—PROPOSED ENERGY CONSERVATION STANDARDS FOR MISCELLANEOUS REFRIGERATION PRODUCTS—Continued

Product class	Equations for maximum energy use (kWh/yr)
4. Built-in coolers ("BIC")	6.30AV + 124.6
C–3A. Cooler with all-refrigerator—automatic defrost	4.11AV + 117.4
C–3A–BI. Built-in cooler with all-refrigerator—automatic defrost	4.67AV + 133.0
C–5–BI. Built-in cooler with refrigerator-freezer—automatic defrost with bottom-mounted freezer	5.47AV + 196.2 + 28I
C–9. Cooler with upright freezer with automatic defrost without an automatic icemaker	5.58AV + 147.7 + 28I
C–9–BI. Built-in cooler with upright freezer with automatic defrost without an automatic icemaker	6.38AV + 168.8 + 28I
C–13A. Compact cooler with all-refrigerator—automatic defrost	4.74AV + 155.0
C–13A–BI. Built-in compact cooler with all-refrigerator—automatic defrost	5.22AV + 170.5

AV = Total adjusted volume, expressed in ft^3, as determined in appendix A to subpart B of 10 CFR part 430.
I = 1 for a product with an automatic icemaker and = 0 for a product without an automatic icemaker.

A. Benefits and Costs to Consumers

Table I.2 presents DOE's evaluation of the economic impacts of the proposed standards on consumers of MREFs, as measured by the average life-cycle cost (''LCC'') savings and the simple payback period (''PBP'').[3] The average LCC savings are positive for all product classes, and the PBP is less than the average lifetime of MREFs, which varies by product class (see section IV.F.6 of this document).

TABLE I.2—IMPACTS OF PROPOSED ENERGY CONSERVATION STANDARDS ON CONSUMERS OF MISCELLANEOUS REFRIGERATION PRODUCTS

Product class	Average LCC savings [2021$]	Simple payback period (years)
FCC	12.6	6.8
FC	28.0	8.0
BICC	2.9	7.9
BIC	57.3	4.0
C–13A	12.0	6.9
C–13A–BI	15.3	6.7
C–3A	31.5	1.7
C–3A–BI	36.7	1.6

Note: See Table I.1 for definition of the product class acronyms.

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

The industry net present value (''INPV'') is the sum of the discounted cash flows starting with the publication year (2023) of the NOPR and extending over a 30-year period following the expected compliance date of the standards (2023 to 2058). Using a real discount rate of 7.7 percent, DOE estimates that the INPV for manufacturers of MREFs, in the case without amended standards is $742.0 million.[4] Under the proposed standards, the change in INPV is estimated to range from −12.1 percent to −8.4 percent, which is approximately −$89.8 million to −$62.7 million. In order to bring products into compliance with amended standards, it is estimated that the industry would incur total conversion costs of $126.9 million.

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 MREFs would save a significant amount of energy. Relative to the case without amended standards, the lifetime energy savings for MREFs purchased in the 30-year period that begins in the anticipated year of compliance with the amended standards (2029–2058) amount to 0.31 quadrillion British thermal units (''Btu''), or quads.[5] This represents a savings of 19.6 percent relative to the energy use of these products in the case without amended standards (refer ed to as the ''no-new-standards case'').

The cumulative net present value (''NPV'') of total consumer benefits of the proposed standards for MREFs ranges from $0.14 billion (at a 7-percent discount rate) to $0.69 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 for miscellaneous refrigeration products purchased in 2029–2058.

In addition, the proposed standards for MREFs are projected to yield significant environmental benefits. DOE estimates that the proposed standards would result in cumulative emission

[3] 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.8 of this document). The simple PBP, which is designed to compare specific efficiency levels, is measured relative to the baseline product (see section IV.C of this document).

[4] Unless otherwise noted, all monetary values in this document are expressed in 2021 dollars.

[5] 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.1 of this document.

reductions (over the same period as for energy savings) of 10.4 million metric tons (''Mt'')[6] of carbon dioxide (''CO_2''), 4.8 thousand tons of sulfur dioxide (''SO_2''), 15.9 thousand tons of nitrogen oxides (''NO_X''), 70.3 thousand tons of methane (''CH_4''), 0.11 thousand tons of nitrous oxide (''N_2O''), and 0.03 tons of mercury (''Hg'').[7] DOE used interim SC–GHG values developed by an Interagency Working Group on the Social Cost of Greenhouse Gases (IWG) for the CO_2 projections.

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).[8] DOE used interim SC–GHG values developed by an Interagency Working Group on the Social Cost of Greenhouse Gases (IWG).[9] The derivation of these values is discussed in section IV.L of this document. For presentational purposes, the monetized climate benefits associated with the average SC–GHG at a 3-percent discount rate are estimated to be $0.5 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 SC–GHG estimates.

DOE estimated the monetary health benefits of SO_2 and NO_X emissions reductions, also discussed in section IV.L of this document. DOE estimated the present value of the monetized health benefits would be $0.3 billion using a 7-percent discount rate, and $0.8 billion using a 3-percent discount rate.[10] 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.

Table I.3 summarizes the economic benefits and costs expected to result from the proposed standards for miscellaneous refrigeration products. There are other important unquantified effects, including certain unquantified climate benefits, unquantified public health benefits from the reduction of toxic air pollutants, direct $PM_{2.5}$ and other emissions, unquantified energy security benefits, and distributional effects, among others.

TABLE I.3—SUMMARY OF MONETIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR MISCELLANEOUS REFRIGERATION PRODUCTS (TSL 4)

[Billion 2021$]

3% discount rate	
Consumer Operating Cost Savings	2.0
Climate Benefits *	0.5
Health Benefits **	0.8
Total Monetized Benefits †	3.3
Consumer Incremental Product Costs ‡	1.3
Monetized Net Benefits	2.0
7% discount rate	
Consumer Operating Cost Savings	0.8
Climate Benefits * (3% discount rate)	0.5
Health Benefits **	0.3
Total Monetized Benefits †	1.6
Consumer Incremental Product Costs	0.7
Monetized Net Benefits	0.9

Note: This table presents the costs and benefits associated with product name shipped in 2029–2058. These results include benefits to consumers which accrue after 2058 from the products shipped in 2029–2058.

* 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, but the Department does not have a single central SC–GHG point estimate. On March 16, 2022, the Fifth Circuit Court of Appeals (No. 22–30087) granted the Federal government's emergency motion for stay pending appeal of the February 11, 2022, preliminary injunction issued in *Louisiana* v. *Biden,* No. 21–cv–1074–JDC–KK (W.D. La.). As a result of the Fifth Circuit's order, the preliminary injunction is no longer in effect, pending resolution of the Federal government's appeal of that injunction or a further court order. Among other things, the preliminary injunction enjoined the defendants in that case from ''adopting, employing, treating as binding, or relying upon'' the interim estimates of the social cost of greenhouse gases—which were issued by the Interagency Working Group on the Social Cost of Greenhouse Gases on February 26, 2021—to monetize the benefits of reducing greenhouse gas emissions. As reflected in this rule, DOE has reverted to its approach prior to the injunction and presents monetized GHG abatement benefits, where appropriate and permissible under law.

** 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, but the Department does not have a single central SC–GHG point estimate. DOE emphasizes the importance and value of considering the benefits calculated using all four SC–GHG estimates.

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.[11]

The national operating savings are domestic private U.S. consumer monetary savings that occur as a result

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

[7] DOE calculated emissions reductions relative to the no-new-standards case, which reflects key assumptions in the *Annual Energy Outlook 2022* (''*AEO 2022*''). *AEO 2022* represents current Federal and state legislation and final implementation of regulations as of the time of its preparation. See section IV.K of this document for further discussion of *AEO 2022* assumptions that effect air pollutant emissions.

[8] On March 16, 2022, the Fifth Circuit Court of Appeals (No. 22–30087) granted the Federal government's emergency motion for stay pending appeal of the February 11, 2022, preliminary injunction issued in *Louisiana* v. *Biden,* No. 21–cv–1074–JDC–KK (W.D. La.). As a result of the Fifth Circuit's order, the preliminary injunction is no longer in effect, pending resolution of the Federal government's appeal of that injunction or a further court order. Among other things, the preliminary injunction enjoined the defendants in that case from ''adopting, employing, treating as binding, or relying upon'' the interim estimates of the social cost of greenhouse gases—which were issued by the Interagency Working Group on the Social Cost of Greenhouse Gases on February 26, 2021—to monetize the benefits of reducing greenhouse gas emissions. As reflected in this rule, DOE has reverted to its approach prior to the injunction and presents monetized GHG abatement benefits where appropriate and permissible under law.

[9] See Interagency Working Group on Social Cost of Greenhouse Gases, Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide. Interim Estimates Under Executive Order 13990, Washington, DC, February 2021 (''February 2021 SC–GHG TSD''). *www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf* (Last accessed September 22, 2022).

[10] 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.

[11] To convert the time-series of costs and benefits into annualized values, DOE calculated a present value in 2022, 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 2022. 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.

of purchasing the covered products and are measured for the lifetime of miscellaneous refrigeration products shipped in 2029–2058. The benefits associated with reduced emissions achieved as a result of the proposed standards are also calculated based on the lifetime of miscellaneous refrigeration products shipped in 2029–2058. 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.4 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 $81.2 million per year in increased equipment costs, while the estimated annual benefits are $97.6 million in reduced equipment operating costs, $28.9 million in monetized climate benefits, and $35.4 million in monetized health benefits. In this case, the monetized net benefit would amount to $80.6 million per year.

Using a 3-percent discount rate for all benefits and costs, the estimated cost of the proposed standards is $81.0 million per year in increased equipment costs, while the estimated annual benefits are $123.1 million in reduced operating costs, $28.9 million in monetized climate benefits, and $49.5 million in monetized health benefits. In this case, the monetized net benefit would amount to $120.4 million per year.

TABLE I.4—ANNUALIZED MONETIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR MISCELLANEOUS REFRIGERATION PRODUCTS (TSL 4)

[Million 2021$/year]

	Primary estimate	Low-net-benefits estimate	High-net-benefits estimate
3% discount rate			
Consumer Operating Cost Savings	123.1	116.3	131.2
Climate Benefits *	28.9	28.1	29.6
Health Benefits **	49.5	48.2	50.8
Total Monetized Benefits †	201.4	192.6	211.6
Consumer Incremental Product Costs †	81.0	82.3	79.4
Monetized Net Benefits	120.4	110.3	132.2
7% discount rate			
Consumer Operating Cost Savings	97.6	92.7	103.3
Climate Benefits * (3% discount rate)	28.9	28.1	29.6
Health Benefits **	35.4	34.6	36.2
Total Monetized Benefits †	161.9	155.4	169.2
Consumer Incremental Product Costs	81.2	82.4	79.8
Monetized Net Benefits	80.6	72.9	89.4

Note: This table presents the costs and benefits associated with miscellaneous refrigeration products shipped in 2029–2058. These results include benefits to consumers which accrue after 2058 from the products shipped in 2029–2058. The Primary, Low-Net-Benefits, and High Net Benefits Estimates utilize projections of energy prices from the AEO 2022 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 section 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 NOPR). For presentational purposes of this table, the climate benefits associated with the average SC–GHG at a 3 percent discount rate are shown, but the Department 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 SC–GHG estimates. On March 16, 2022, the Fifth Circuit Court of Appeals (No. 22–30087) granted the Federal government's emergency motion for stay pending appeal of the February 11, 2022, preliminary injunction issued in *Louisiana* v. *Biden,* No. 21–cv–1074–JDC–KK (W.D. La.). As a result of the Fifth Circuit's order, the preliminary injunction is no longer in effect, pending resolution of the Federal government's appeal of that injunction or a further court order. Among other things, the preliminary injunction enjoined the defendants in that case from ''adopting, employing, treating as binding, or relying upon'' the interim estimates of the social cost of greenhouse gases—which were issued by the Interagency Working Group on the Social Cost of Greenhouse Gases on February 26, 2021—to monetize the benefits of reducing greenhouse gas emissions. As reflected in this rule, DOE has reverted to its approach prior to the injunction and presents monetized GHG abatement benefits where appropriate and permissible under law.

** 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. 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 benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate, but the Department does not have a single central SC–GHG point estimate.

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 products achieving these standard levels are already commercially available for all product 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 NO_X and SO_2 reduction benefits, and a 3-percent discount rate case for GHG social costs, the estimated cost of the proposed standards for miscellaneous refrigeration products is $81.2 million per year in increased product costs, while the estimated annual benefits are $97.6 million in reduced product operating costs, $28.9 million in monetized climate benefits and $35.4 million in monetized health benefits. The net monetized benefit amounts to $80.6 million per year.

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.[12] 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 proposed standards are projected to result in estimated national energy savings of 0.31 quad (FFC), the equivalent of the electricity use of 3.4 million homes in one year. In addition, they are projected to reduce GHG emissions. The NPV of consumer benefit for these projected energy savings is $0.14 billion using a discount rate of 7 percent, and $0.69 billion using a discount rate of 3 percent. The cumulative emissions reductions associated with these energy savings are 10.4 Mt of CO_2, 4.8 thousand tons of SO_2, 15.9 thousand tons of NO_X, 0.03 tons of Hg, 70.3 thousand tons of CH_4, and 0.11 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) is $0.5 billion. The estimated monetary value of the health benefits from reduced SO_2 and NO_X emissions is $0.3 billion using a 7-percent discount rate and $0.8 billion using a 3-percent discount rate. As such, 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 this tentative conclusion 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 miscellaneous refrigeration products.

A. Authority

EPCA authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. Title III, Part B of EPCA established the Energy Conservation Program for Consumer Products Other Than Automobiles which, in addition to identifying particular consumer products and commercial equipment as covered under the statute, permits the Secretary of Energy to classify additional types of consumer products as covered products. (42 U.S.C. 6292(a)(20)) DOE added MREFs as covered products through a final determination of coverage published in the **Federal Register** on July 18, 2016 (the ''July 2016 Final Coverage Determination''). 81 FR 46768. MREFs are consumer refrigeration products other than refrigerators, refrigerator-freezers, or freezers, which include coolers and combination cooler refrigeration products. 10 CFR 430.2. MREFs include refrigeration products such as coolers (*e.g.,* wine chillers and other specialty products) and combination cooler refrigeration products (*e.g.,* wine chillers and other specialty compartments combined with a refrigerator, refrigerator-freezers, or freezers). 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. 6295(m)(1)) Not later than three years after issuance of a final determination not to amend standards, 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. 6295(m)(3)(B))

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 specifically include definitions (42 U.S.C. 6291), test procedures (42 U.S.C. 6293), labeling provisions (42 U.S.C. 6294), energy conservation standards (42 U.S.C. 6295), and the authority to require information and reports from manufacturers (42 U.S.C. 6296).

Federal energy efficiency requirements for covered products established under EPCA generally supersede State laws and regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6297(a)–(c)) 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. 6297(d))

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 product. (42 U.S.C. 6295(o)(3)(A) and 42 U.S.C. 6295(r)) Manufacturers of covered products must use the prescribed DOE test procedure as the basis for certifying to DOE that their products comply with the applicable energy conservation standards adopted under EPCA and when making representations to the public regarding the energy use or efficiency of those products. (42 U.S.C. 6293(c) and 42 U.S.C. 6295(s)) Similarly, DOE must use these test procedures to determine whether the products comply with standards adopted pursuant to EPCA. (42 U.S.C. 6295(s)). The DOE test procedures for miscellaneous refrigeration products appears at 10 CFR part 430, subpart B, appendix A,

[12] 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).

Uniform Test Method for Measuring the Energy Consumption of Refrigerators, Refrigerator-Freezers, and Miscellaneous Refrigeration Products (''appendix A'').

DOE must follow specific statutory criteria for prescribing new or amended standards for covered products, including refrigerators, refrigerator-freezers, and freezers. 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 (''Secretary'') determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A) and 6295(o)(3)(B)) 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 refrigerators, refrigerator-freezers, and freezers, 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. 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. 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 considers relevant.

(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. 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. 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. 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. 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. 6295(q)(2))

Finally, pursuant to the amendments contained in the Energy Independence and Security Act of 2007 (''EISA 2007''), Public Law 110–140, any final rule for new or amended energy conservation standards promulgated after July 1, 2010, is required to address standby mode and off mode energy use. (42 U.S.C. 6295(gg)(3)) Specifically, when DOE adopts a standard for a covered product after that date, it must, if justified by the criteria for adoption of standards under EPCA (42 U.S.C. 6295(o)), incorporate standby mode and off mode energy use into a single standard, or, if that is not feasible, adopt a separate standard for such energy use for that product. (42 U.S.C. 6295(gg)(3)(A)–(B)) DOE's current test procedures for miscellaneous refrigeration products address standby mode and off mode energy use. In this rulemaking, DOE intends to incorporate such energy use into any amended energy conservation standards that it may adopt.

B. Background

1. Current Standards

DOE added MREFs as covered products through a final determination of coverage published in the **Federal Register** on July 18, 2016 (the ''July 2016 Final Coverage Determination''). 81 FR 46768. In that determination, DOE noted that MREFs, on average, consume more than 150 kilowatt hours per year (''kWh/yr'') and that the aggregate annual national energy use of these products exceeds 4.2 terawatt hours (''TWh''). 81 FR 46768, 46775. In addition to establishing coverage, the July 2016 Final Coverage Determination established definitions for ''miscellaneous refrigeration products,'' ''coolers,'' and ''combination cooler refrigeration products'' in 10 CFR 430.2. 81 FR 46768, 46791–46792.

On October 28, 2016, DOE published a direct final rule (the ''October 2016 Direct Final Rule'') in which it adopted energy conservation standards for MREFs consistent with the recommendations from a negotiated rulemaking working group established under the Appliance Standards and Rulemaking Federal Advisory Committee. 81 FR 75194. Concurrent with the October 2016 Direct Final Rule, DOE published a NOPR in which it proposed and requested comments on the standards set forth in the direct final rule. 81 FR 74950. On May 26, 2017, DOE published a notice in the **Federal Register** in which it determined that the comments received in response to the October 2016 Direct Final Rule did not provide a reasonable basis for withdrawing the rule and, therefore, confirmed the adoption of the energy conservation standards established in that direct final rule. 82 FR 24214.

These current standards for MREFs are set forth in DOE's regulations at 10 CFR 430.32(aa)(1)–(2) and are repeated solely for reference in Table II.1 to aid the reader.

TABLE II.1—FEDERAL ENERGY CONSERVATION STANDARDS FOR MREFs

Product class	Equations for maximum energy use (kWh/yr)
1. Freestanding compact coolers (“FCC”)	7.88AV + 155.8
2. Freestanding coolers (“FC”)	7.88AV + 155.8
3. Built-in compact coolers (“BICC”)	7.88AV + 155.8
4. Built-in coolers (“BIC”)	7.88AV + 155.8
C–3A. Cooler with all-refrigerator—automatic defrost	4.57AV + 130.4
C–3A–BI. Built-in cooler with all-refrigerator—automatic defrost	5.19AV + 147.8
C–9. Cooler with upright freezer with automatic defrost without an automatic icemaker	5.58AV + 147.7
C–9–BI. Built-in cooler with upright freezer with automatic defrost without an automatic icemaker	6.38AV + 168.8
C–9I. Cooler with upright freezer with automatic defrost with an automatic icemaker	5.58AV + 231.7
C–9I–BI. Built-in cooler with upright freezer with automatic defrost with an automatic icemaker	6.38AV + 252.8
C–13A. Compact cooler with all-refrigerator—automatic defrost	5.93AV + 193.7
C–13A–BI. Built-in compact cooler with all-refrigerator—automatic defrost	6.52AV + 213.1

AV = Total adjusted volume, expressed in ft^3, as determined in appendix A to subpart B of 10 CFR part 430.

2. History of Standards Rulemaking for Miscellaneous Refrigeration Products

On December 8, 2020, DOE published a notice that it was initiating an early assessment review to determine whether any new or amended standards would satisfy the relevant requirements of EPCA for a new or amended energy conservation standard for MREFs and a request for information (''RFI''). 85 FR 78964 (''December 2020 Early Assessment Review RFI'').

Comments received following the publication of the December 2020 Early Assessment Review RFI helped DOE identify and resolve issues related to the subsequent preliminary analysis.[13] DOE published a notice of public meeting and availability of the preliminary technical support document (''TSD'') on January 21, 2022 (''January 2022 Preliminary Analysis''). 87 FR 3229. DOE subsequently held a public meeting on March 7, 2022, to discuss and receive comments on the January 2022 Preliminary Analysis. The January 2022 Preliminary Analysis that presented the methodology and results of the preliminary analysis is available at: *www.regulations.gov/document/EERE-2020-BT-STD-0039-0009.*

DOE received five docket comments in response to the January 2022 Preliminary Analysis from the interested parties listed in Table II.1.

TABLE II.1—JANUARY 2022 PRELIMINARY ANALYSIS WRITTEN COMMENTS

Organization(s)	Reference in this NOPR	Organization type
Association of Home Appliance Manufacturers	AHAM	Trade Organization.
Appliance Standards Awareness Project	ASAP	Efficiency Organization.
California Investor-Owned Utilities	CA IOUs	Utility Supplier.
Northwest Energy Efficiency Alliance	NEEA	Efficiency Organization.
Sub Zero Group, Inc	Sub Zero	Manufacturer.

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[14]

3. Test Procedure

EPCA sets forth generally applicable criteria and procedures for DOE's adoption and amendment of test procedures. (42 U.S.C. 6293) Manufacturers of covered products must use these test procedures to certify to DOE that their product complies with energy conservation standards and to quantify the efficiency of their product.

On October 12, 2021, DOE published in the **Federal Register** a final rule amending the test procedures for MREFs and other consumer refrigeration products at appendix A and appendix B of 10 CFR part 430 (the ''October 2021 TP Final Rule''). 86 FR 56790 (October 12, 2021). The October 2021 TP Final Rule incorporates by reference the most recent industry test procedure, AHAM Standard HRF–1, ''Energy and Internal Volume of Consumer Refrigeration Products'' (''AHAM HRF–1–2019''). However, DOE did not require the change in icemaker energy use included in the 2019 revision of HRF–1. 86 FR 56793. While DOE had proposed to implement this change in the proposed test procedure rulemaking (84 FR 70842, 70848–70850 (December 23, 2019)), DOE indicated in the October 2021 TP Final Rule that it would not require the calculations until the compliance dates of any amended energy conservation standards for these products, which incorporated the amended automatic icemaker energy consumption. 86 FR 56793. DOE determined that the test procedure amendments are not expected to impact the measured energy use of consumer refrigeration products, including MREFs, as compared to the test procedure in place at the time of the October 2021 Test Procedure Final Rule. 86 FR 56790.

[13] Comments are available at *www.regulations.gov/docket/EERE-2020-BT-STD-0039/comments.*

[14] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to develop energy conservation standards for miscellaneous refrigeration products. (Docket No. EERE–2020–BT–STD–0039, which is maintained at *https://www.regulations.gov/document/EERE-2020-BT-STD-0039*). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

The analysis presented in this NOPR is based on the test procedure as finalized in the October 2021 TP Final Rule, except for the calculation of the change in energy use attributed to icemaker energy use, which aligns with the icemaker energy use in HRF–1–2019. The value of the revised icemaker energy use and the plans to implement this change coincident with the date of future energy conservation standards were discussed at length in the October 2021 TP Final Rule. (*See* 86 FR 56822, October 12, 2021) Hence, this change is proposed in this document.

4. Off Mode and Standby Mode

Pursuant to the amendments contained in the Energy Independence and Security Act of 2007 (''EISA 2007''), Public Law 110–140, any final rule for new or amended energy conservation standards promulgated after July 1, 2010, is required to address standby mode and off mode energy use. (42 U.S.C. 6295(gg)(3)) Specifically, when DOE adopts a standard for a covered product after that date, it must, if justified by the criteria for adoption of standards under EPCA (42 U.S.C. 6295(o)), incorporate standby mode and off mode energy use into a single standard, or, if that is not feasible, adopt a separate standard for such energy use for that product. (42 U.S.C. 6295(gg)(3)(A)–(B)) DOE test procedures for refrigeration products measure the energy use of these products during extended time periods that include periods when the compressor and other key components are cycled off. All of the energy these products use during the ''off cycles'' is already included in the measurements. 79 FR 22320, 22345. The approach of testing with connected functions on but not connected to a network account for energy consumption of such functions as part of active mode testing, and as a result, this method provides consumers with representative estimates of energy consumption.

C. Deviation From Appendix A

In accordance with section 3(a) of 10 CFR part 430, subpart C, appendix A (''appendix A''), DOE notes that it is deviating from the provision in appendix A regarding the pre-NOPR stages for an energy conservation standards rulemaking. Section 6(a)(2) of appendix A states that if the Department 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. For the reasons that follow, DOE finds it appropriate to deviate from this step-in appendix A and to instead publish this NOPR without issuing a framework document. A framework document is intended to introduce and summarize the various analyses DOE conducts during the rulemaking process and requests initial feedback from interested parties. As discussed in the preceding section, prior to this NOPR, DOE issued an early assessment request for information in which DOE identified and sought comment on the analyses conducted in support of the most recent energy conservation standards rulemaking, for which, DOE provided a 75-day comment period. 85 FR 78964, 78965–78966 (Dec. 8, 2020) (the ''December 2020 Early Assessment Review RFI'') DOE then issued the January 2022 Preliminary Analysis, seeking further general comments from stakeholders regarding the analyses conducted to support the upcoming standards rulemaking, for which, DOE provided a 60-day comment period for the January 2022 Preliminary Analysis. 87 FR 3229 (Jan. 21, 2022)

As DOE is intending to rely on substantively the same analytical methods as in the most recent rulemaking, publication of a framework document would be largely redundant with the published early assessment RFI and preliminary analysis. As such, DOE is not publishing a framework document.

Section 6(f)(2) of appendix A provides that the length of the public comment period for the NOPR will be at least 75 days. For this NOPR, DOE finds it appropriate to provide a 60-day comment period. As previously discussed, DOE provided a 60-day comment period on January 2022 Preliminary Analysis. 87 FR 3229. DOE subsequently held a public meeting on March 7, 2022, to discuss and received comments on the January 2022 Preliminary Analysis. Consequently, DOE has determined it is appropriate to provide a 60-day comment period on the NOPR, which the Department believes 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.

A. Product Classes and Scope of Coverage

When evaluating and establishing energy conservation standards, DOE divides covered products into product classes by the type of energy used or by capacity or other performance-related features that justify differing standards. 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. (42 U.S.C. 6295(q))

To simplify the structure for presentation of maximum allowable energy use equations, DOE is proposing, for class pairs for which one class includes an icemaker and the other does not, to represent the icemaker energy use adder in a single energy use equation rather than in two separate equations. The product class discussion in section IV below explores this issue further. In addition, DOE is proposing standard levels for a new class covering built-in combination cooler-refrigerator-freezers with a bottom-mounted freezer, both with and without an automatic icemaker, (''combination cooler 5–BI''). This is also discussion in greater detail in section IV of this document.

B. Definitions

In 10 CFR 430.2, DOE has established definitions for a variety of refrigeration products, including refrigerators, refrigerator-freezers, freezers, and coolers and combination cooler refrigeration products defined as MREFs. DOE recognizes that there are some products that may, based on their physical and operational characteristics, meet more than one of the definitions in § 430.2. This includes certain combination cooler refrigeration products, such as cooler-refrigerators, cooler-refrigerator-freezers, or cooler-freezers. When standards for miscellaneous refrigeration products were established, they were not established for all potential combination products. Rather, standards were established for combination products that were on the market at the time of the final rule. 81 FR 75194, 75210, 75215–75216 (October 28, 2016). In doing so, DOE anticipated that manufacturers would eventually introduce combination products for which standards were not originally established under § 430.32(aa). In these cases, a particular product could also meet the definition of a refrigerator, refrigerator-freezer, or freezer. To specifically delineate between those products and MREF products currently subject to an energy conservation standard in § 430.32(aa), the definitions of refrigerator, refrigerator-freezer, or freezer in § 430.2 contain a provision that excludes any miscellaneous refrigeration product that must comply with an applicable miscellaneous refrigeration product energy conservation standard. Consequently, MREF products not exempted by that provision may still be defined as a refrigerator, refrigerator-freezer, or freezer.

In this NOPR, DOE is clarifying that a product that combines a cooler with a refrigerator, refrigerator-freezer, or freezer that otherwise meets the definition of one of those product types in § 430.2 and is not excluded from the definition through coverage by a standard in 10 CFR 430.32(aa) as a miscellaneous refrigeration product, must be tested and certified as a refrigerator, refrigerator-freezer, or freezer according to the applicable test procedure in appendix A or appendix B (with additional instruction addressing the cooler compartment of a cooler-freezer, as applicable—these additional instructions are discussed in section III.C of this document), be certified according to the certification requirements in 10 CFR 429.14, and meet the energy conservation standard for the applicable product class of refrigerator, refrigerator-freezer, or freezer. DOE concludes that the current regulations require this approach for such products and is proposing the changes to the regulatory language simply as clarification.

To ensure this clarification is properly applied, DOE identified potential clarifying amendments to the refrigerator and freezer definitions in § 430.2 that would lead to the appropriate determination of coverage for combination refrigeration products that do not have a prescribed MREF energy conservation standard. In particular, in this NOPR DOE proposes to amend the refrigerator and freezer definitions to clarify that the definitions do apply to products that have a cooler compartment included in addition to the fresh food compartment (for a refrigerator) or freezer compartment (for a freezer). DOE notes that this coverage status is already clear in the refrigerator-freezer definition, which explicitly allows for additional compartments other than the fresh food and freezer compartments, which are defined based on operating temperature, by including allowing the product to have compartments that may operate outside these defined parameters. DOE's proposal would make similar clarifications for the refrigerator and freezer definitions.

DOE requests comment on its proposal to amend the refrigerator and freezer definitions in § 430.2 to clarify that products that would otherwise be considered a refrigerator or a freezer that also include a cooler compartment would be considered a refrigerator or a freezer, unless a miscellaneous refrigeration product energy conservation standard in § 430.32(aa) is applicable for the product.

C. Test Procedure

EPCA sets forth generally applicable criteria and procedures for DOE's adoption and amendment of test procedures. (42 U.S.C. 6293) Manufacturers of covered products must use these test procedures to certify to DOE that their product complies with energy conservation standards and to quantify the efficiency of their product. DOE's current energy conservation standards for miscellaneous refrigeration products are expressed in terms of Annual Energy Use, expressed in kWh/year. (See 10 CFR 430.32(a).)

As previously discussed, DOE planned to delay adopting for consumer refrigeration products the revised icemaker energy use adder of 28 kWh/yr that is in AHAM HRF–1–2019—which is the industry test standard—until the compliance date of a possible amended standard. As discussed in the October 2021 TP final rule, DOE determined it would not require testing with the amended icemaker energy use adder until the compliance dates of the next amended energy conservation standards for refrigeration products. 86 FR 56815. Therefore, as discussed previously, this NOPR proposes product classes that implement the 28 kWh/year icemaker adder, consistent with the icemaker energy use in HRF–1–2019, and also proposes to adopt the updated icemaker adder for MREF, to be used on or after the compliance date of revised standards.

As previously discussed, DOE is proposing clarifying amendments to product definitions indicating that products that include a cooler compartment in addition to a fresh food or freezer compartment but do not have an MREF energy conservation standard, would still meet the refrigerator or freezer definitions, as applicable. Additionally, DOE is proposing clarifying amendments to appendix A and appendix B, as it relates to testing combination cooler-freezers as well as testing combination refrigeration products that do not have a prescribed MREF energy conservation standards.

Specifically, DOE is proposing to add sub-sections to appendix A and appendix B to clarify the calculation of average per-cycle energy consumption for combination cooler-freezers and freezers with a cooler compartment, by referring to section 5.9.3 of HRF–1 2019 and stating specific ''k'' values to be used in equations presented therein. DOE also proposes to amend appendix B section 5.2 to refer to section 5.2 of appendix A when testing freezers with cooler compartments, because the appendix A requirements are more appropriate for products with more than one compartment. Lastly, DOE proposes to amend appendix B by adding a clarification to section 5.3 to specify the value of variable ''K'' when referencing section 5.8.2 of HRF–1–2019.

ASAP stated in response to the January 2022 Preliminary Analysis that they understand that produce growers with a source of refrigeration likely meet the definition of a cooler but, due to unique components present in a produce grower that maintain an environment with temperature and humidity controls that are conducive to growing plants, produce growers cannot be tested in the same manner as coolers whose primary function is to chill beverage products. NEEA commented on a need for implementing different test procedures for produce growers, citing technology differences between produce growers and other miscellaneous refrigeration products. NEEA stated that test procedures for produce growers should include energy use measurements for cabinet temperature and humidity control systems, water distribution systems, and carbon dioxide injection systems. ASAP and NEEA encouraged DOE to establish test procedures for these products. (ASAP, No. 19, p. 3; NEEA, No. 21, pp. 3–4)

DOE is aware of the produce grower market and appreciates input on this topic. At this point, only GE Appliances, a Haier Company (''GEA'') has submitted a petition for waiver from test procedures covering MREFs. GEA initially also requested an interim waiver. In an initial denial of the petition for interim waiver, DOE tentatively concluded that the GEA model meets the definition of a cooler, because the product consists of a cabinet used with one or more doors, and maintains compartment temperatures no lower than 39 degrees Fahrenheit, as determined when tested in a 90-degree Fahrenheit ambient temperature. 86 FR 35766, 35768 (July 7, 2021). In addition to this, DOE tentatively determined that the requested alternate test procedure would not result in measured energy use of the basic model that is representative of actual energy used during representative average use. *Id.* In November 2021, GEA submitted a revised petition for waiver and interim waiver for its grower product that proposed a revised alternative test method designed to address the concerns that DOE expressed in its denial of the GEA's original petition. Having considered the merits of GEA's revised approach, and receiving no comments in opposition, DOE approved use of the revised alternate test procedure for rating GEA's product through the publication of a notification of decision and order on October 17, 2022 (87 FR 62835), reiterating that while the In-Home Grower basic model meets the cooler definition, it is not subject to the cooler energy conservation standards because of its unique characteristics, as discussed in the November 2021 Notification of Petition for Waiver. (87 FR 62835, 62838)

In consideration of the other produce growers mentioned in ASAP's comment—the Viking Under-counter Micro Green & Herb Cabinet—GCV12, the Seedo Automated Home Grow Device, and the Bloom In-Home Grow System—DOE has not received waiver petitions for these products but will consider investigating these products, including whether they may be subject to testing requirements based on meeting the definition of an MREF product, as GEA's product does.

NEEA advocated for the implementation of a test procedure to calculate the energy impact of interior lighting in all miscellaneous refrigeration products. NEEA claims that the use of lighting differs largely depending on manufacturer and personal usage, and with the proliferation of glass doors for coolers, interior lighting plays a large role in energy calculations. (NEEA, No. 21, pp. 4–5)

AHAM states the vast majority of the miscellaneous refrigeration product designs on the market no longer use incandescent lighting and have shifted to light-emitting diode (''LED'') technology, meaning efficiency gains from lighting are limited, and efforts to further regulate lighting options in miscellaneous refrigeration products will place undue burden on manufacturers. (AHAM, No. 18, p. 7)

The test procedure does not include measurement of energy use with lighting turned on. DOE last finalized its test procedure for consumer refrigeration products including MREFs on October 12, 2021. 86 FR 56790. As part of the rulemaking to establish this test procedure, DOE published a request for information (''RFI'') (82 FR 29780) on June 30, 2017, and a NOPR (84 FR 70842) on December 23, 2019. No comments in response to the RFI or NOPR suggested that lighting energy use should be included as part of the test procedure. In the final rule initially establishing the test procedures for MREF on July 18, 2016, DOE indicated that it set the requirement to test these products with light switches in the off position based on field surveys indicating that 90 percent of consumers kept light switches off in coolers. 81 FR 46768, 46782. This requirement was also consistent with the recommendations of the Working Group that negotiated MREF test procedures and energy conservation standards under the auspices of the Appliance Standards and Rulemaking Federal Advisory Committee (''ASRAC''). *Id.* When DOE next considers revisions to the test procedure for MREF, DOE may request information regarding trends affecting lighting energy use in these products, and, based on information obtained, may consider at that time, whether the test procedure should be revised to include lighting energy.

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 products or 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 products or in working prototypes to be technologically feasible. Sections 6(b)(3)(i) and 7(b)(1) of CFR 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 product utility or availability; (3) adverse impacts on health or safety, and (4) unique-pathway proprietary technologies. 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 miscellaneous refrigeration products, 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 technical support document (''TSD'').

2. Maximum Technologically Feasible Levels

When DOE proposes to adopt an 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 product. (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 miscellaneous refrigeration products, using the design parameters for the most efficient products 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.c 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 miscellaneous refrigeration products purchased in the 30-year period that begins in the year of compliance with the proposed standards (2029–2058).[15] The savings are measured over the entire lifetime of miscellaneous refrigeration products 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 a product 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 miscellaneous refrigeration products.

[15] Each TSL is composed of specific efficiency levels for each product 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.

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 NES 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.[16] 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 a covered product, 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.[17] For example, some covered products and equipment have most of their 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, taking into account the significance of cumulative FFC national energy savings, the cumulative FFC emissions reductions, health benefits, 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. 6295(o)(3)(B).

[16] 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).

[17] 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).

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. 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 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 manufacturing 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[18] 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 product 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 products that are likely to result from a standard. (42 U.S.C. 6295(o)(2)(B)(i)(II)) DOE conducts this comparison in its LCC and PBP analysis.

[18] For this NOPR, DOE analyzed the impacts of the considered standard levels on senior-only households.

The LCC is the sum of the purchase price of a product (including its installation) and the operating expense (including energy, maintenance, and repair expenditures) discounted over the lifetime of the product. The LCC analysis requires a variety of inputs, such as product prices, product energy consumption, energy prices, maintenance and repair costs, product lifetime, and discount rates appropriate for consumers. To account for uncertainty and variability in specific inputs, such as product 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 a more-efficient product 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 products 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. 6295(o)(2)(B)(i)(III)) As discussed in section III.E, DOE uses the NIA spreadsheet model to project NES.

d. Lessening of Utility or Performance of Products

In establishing product 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 products. (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 products 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. 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. 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. 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 and health 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; the estimated emissions impacts are reported in section I.B.6 of this document. DOE also estimates the economic value of emissions reductions resulting from the considered TSLs, as discussed in section IV.L 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. 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

As set forth in 42 U.S.C. 6295(o)(2)(B)(iii), EPCA creates a rebuttable presumption that an energy conservation standard is economically justified if the additional cost to the consumer of a product 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. 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. 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 IV.F.9 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 miscellaneous refrigeration products. Separate paragraphs 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 rulemaking: *www.regulations.gov/docket/EERE-2020-BT-STD-0039.* 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.

DOE received some comments in response to the January 2022 Preliminary Analysis that, rather than addressing specific aspects of the analysis, are general statements regarding the appropriateness of amending energy conservation standards and/or the efficiency levels that might be appropriate.

AHAM stated they support DOE in its efforts to ensure a national marketplace through the Appliance Standards Program. AHAM also stated that amended standards for MREFs may not be justified under EPCA given the relatively low number of shipments in the MREF product category and the limited opportunity for energy savings that result from that fact. AHAM therefore stated, especially given DOE's large backlog of rulemakings (many of which involve products with larger energy savings opportunities), DOE should prioritize other rulemakings. (AHAM, No. 18, p. 1)

While miscellaneous refrigeration products have a smaller number of shipments when compared to refrigerators, refrigerator-freezers, and freezers, (''RFs''), that is not a factor DOE considers in determining when to proceed with reviewing a standard. DOE is mandated by 42 U.S.C. 6295(m)(1) to reconsider energy standards no later than 6 years after issuance of any final rule establishing or amending standards.

A. Market and Technology Assessment

DOE develops information in the market and technology assessment that provides an overall picture of the market for the products concerned, including the purpose of the products, the industry structure, manufacturers, market characteristics, and technologies used in the products. 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 product 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 miscellaneous refrigeration products. 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. Scope of Coverage and Product Classes

In the January 2022 Preliminary Analysis, DOE identified one potential product class modification for miscellaneous refrigeration products. DOE did receive a comment in response to the January 2022 Preliminary Analysis regarding the product class structure, which is addressed.

a. Product Classes With Automatic Icemakers

DOE has identified an opportunity to simplify and consolidate the presentation of maximum allowable energy use for products within product classes that may or may not have an automatic icemaker.

To represent the annual energy consumed by automatic icemakers in MREFs, DOE's test procedures specify a constant energy-use adder of 84 kWh/year (by use of a 0.23 kWh/day adder; see section 5.3(a)(i) of 10 CFR part 430, subpart B, appendix A and section 5.3.(a) of appendix B). With this constant adder, the standard levels for product classes with an automatic icemaker are equal to the standards of their counterparts without an icemaker plus the 84 kWh/year. Consistent with prior discussions in the test procedure rulemaking, this NOPR proposes to amend this equation such that representations made on or after the compliance date of any potential new energy conservation standards, the adder to be used shall change from 84 kWh/yr to 28 kWh/yr. DOE determined as part of the October 2021 TP Final Rule that the revised adder would more accurately reflect energy use during a representative average use cycle. 86 FR 56811. However, DOE indicated that it would not require this change in the test procedure until the date of potential future energy conservation standard amendments. *Id.* at 86 FR 56793. Thus, this change is being proposed in this document, with an implementation date to coincide with the compliance date of the standards proposed in this document.

DOE has concluded that because the standards for the product classes with and without automatic icemakers are effectively the same, except for the constant adder, there is an opportunity to express the maximum allowable energy use for both icemaking and non-icemaking classes with the same equation, thus consolidating the presentation of classes and simplifying the energy conservation standards. The equation would, for those classes that may or may not have an icemaker, include a term equal to the icemaking energy use adder multiplied by a factor that is defined to equal 1 for products with icemakers and to equal zero for products without icemakers. This approach would consolidate the product class structure with a single product class descriptor and maximum energy use equation, while continuing to reflect that products with and without icemakers may have different maximum energy use values.

DOE requests comments on its proposal to consolidate the presentation of maximum allowable energy use for products of classes that may or may not have an automatic icemaker.

b. Addition of a Built-In Combination Cooler-Refrigerator-Freezer With Bottom-Mounted Freezer and Automatic Icemaker Product Class

Sub Zero stated they are planning to introduce a built-in combination cooler-refrigerator-freezer with bottom-mounted freezer and automatic icemaker. Sub Zero noted, although this configuration is an MREF covered product, it was not on the market in 2016 so a standard level was not set; using the same methodology used to set levels for the eight combination cooler types for which a standard was prescribed, the allowable maximum energy use would be 6.08AV + 302 kWh/yr. Sub Zero stated it is their understanding that they will need to request exception relief from DOE to certify this new product and requested that a future standard level for this product class be set in the upcoming MREF rulemaking. (Sub Zero, No. 17, pp. 2–3)

DOE is proposing energy use levels for the built-in combination cooler-refrigerator-freezer with a bottom-mounted freezer, with and without an automatic icemaker (''combination cooler 5–BI''), as requested by Sub Zero.[19] DOE agrees with Sub Zero that the baseline energy use for the class with an automatic icemaker would be using the methodology established in the MREF negotiations for setting energy use standards for new classes of combination products, if calculated on the basis of the 84 kWh/yr icemaker energy use of the current test procedure. When considering the revised 28 kWh/yr icemaker, to be implemented at the compliance date of any amended energy conservation standards, the baseline energy use equation for the product class would be 6.08AV + 246 kWh/yr. Since there are no products on the market that could serve as the basis for analysis to support setting a future standard, DOE is using combination cooler class 3A as a proxy for setting of a future energy conservation standard for the new combination cooler 5–BI class.

DOE requests comment on its proposal to establish energy conservation standards for combination cooler 5–BI using the analysis for combination class 3A as proxy for setting the standard level, based on a baseline efficiency equal to 6.08AV + 218 +28*I kWh/yr, where I is equal to 0 if the model has no automatic icemaker and equal to 1 if it does.

2. Technology Options

In the preliminary market analysis and technology assessment, DOE identified 37 technology options that would be expected to improve the efficiency of miscellaneous refrigeration products, as measured by the DOE test procedure:

Table IV.1—Technology Options Identified in the Preliminary Analysis

Insulation
1. Improved resistivity of insulation (insulation type)
2. Increased insulation thickness
3. Vacuum-insulated panels
4. Gas-filled insulation panels

Gaskets and Anti-Sweat Heat
5. Improved gaskets
6. Double door gaskets

[19] Although Sub Zero requested a new class only for models with an automatic icemaker, DOE is extending the proposal to also include products without an automatic icemaker, consistent with the consolidation of the icemaker energy use into the energy use equation in the presentation of energy use standards.

7. Anti-sweat heat

Doors

8. Low-E coatings
9. Inert gas fill
10. Vacuum-insulated glass
11. Additional panes
12. Frame design
13. Solid door

Compressor

14. Improved compressor efficiency
15. Variable-speed compressors
16. Linear compressors

Evaporator

17. Increased surface area
18. Forced-convection evaporator
19. Tube and fin enhancements (including microchannel designs)
20. Multiple evaporators

Condenser

21. Increased surface area
22. Tube and fin enhancements (including microchannel designs
23. Forced-convection condenser

Defrost System

24. Off-cycle defrost
25. Reduced energy for active defrost
26. Adaptive defrost
27. Condenser hot gas defrost

Control System

28. Electronic temperature control
29. Air-distribution control

Other Technologies

30. Fan and fan motor improvements
31. Improved expansion valve
32. Fluid control or solenoid off-cycle valve
33. Alternative refrigerants
34. Improved refrigerant piping
35. Component location
36. Alternative refrigeration systems

Commenters provided feedback on some of these technology options. These comments are summarized below, along with DOE's responses.

AHAM stated several of the evaluated technology options are impractical or provide limited to no benefit given current manufacturing and design processes past EL 1. However, AHAM did not provide sufficient detail that would enable DOE to revise the listed technology options and subsequent analysis. (AHAM, No. 18, p. 7)

AHAM also cited issues with DOE's use of LED lighting in its analysis, DOE's over-reliance on vacuum-insulated panels (''VIPs'') in its analysis, and an insufficient supply of variable-speed compressors (''VSCs''). Specifically, AHAM states that the widespread use of LED lighting in the market currently means the possible efficiency gains from lighting will be limited. When considering VIPs, AHAM argues that DOE overused VIPs in its analysis in a manner that is not consistent with their current use on the market or overall effectiveness. Finally, AHAM points to the use of VSCs in the higher ELs as risky due to a potential shortfall of supply from manufacturers if they are included in a standards rulemaking as a primary design option for energy efficiency. (AHAM, No. 18, p. 7)

DOE is aware of the widespread use of LED lighting in the market currently. Therefore, lighting technologies were not considered as a technology option in the preliminary analysis. Likewise, they were also not considered in the NOPR analysis.

When considering the impact of VIPs, DOE took into consideration relevant rulemaking analyses for refrigerator, refrigerator-freezer, and freezer classes as a basis for VIP effectiveness as well as manufacturer feedback. With this information, VIP implementation in the NOPR analysis was more limited than in the preliminary analysis. For this analysis VIPs were only implemented partially in the max-tech levels of every directly analyzed class.

The impact of VSCs on the miscellaneous refrigeration product analyses was primarily based on their ability to provide a higher level of efficiency when compared to their single-speed counterparts. As a result of this compressor efficiency increase, they are prevalent in the higher ELs of the efficiency analyses. DOE acknowledges that more stringent standards would likely necessitate adoption of more efficient technologies, such as variable-speed compressors. However, DOE expects that standards, if adopted, would provide sufficient certainty for manufacturers and suppliers to establish additional capacity in the supply chain, if needed.

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 products or in working prototypes will not be considered further.

(2) *Practicability to manufacture, install, and service.* If it is determined that mass production and reliable installation and servicing of a technology in commercial products 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 or product availability.* If it is determined that a technology would have a significant adverse impact on the utility of the product for significant subgroups of consumers or would result in the unavailability of any covered product type with performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as products generally available in the United States at the time, it will not be considered further.

(4) *Adverse impacts on health or safety.* 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 design option utilizes proprietary technology that represents a unique pathway to achieving a given efficiency level, that technology will not be considered further due to the potential for monopolistic concerns.

10 CFR part 430, subpart C, appendix A, sections 6(b)(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

In the January 2022 Preliminary Analysis, DOE screened out the following technologies on the basis of technological feasibility, practicability to manufacture, install, and service, adverse impacts on utility or availability, adverse impacts on health or safety, and use of unique-pathway proprietary technologies.

Table IV.2—Technologies Screened Out in the Preliminary Analysis

Solid doors
Ultra-low-E (reflective) glass doors
Vacuum-insulated glass
Improved gaskets and double gaskets
Linear compressors
Fluid control or solenoid off-cycle valves
Evaporator tube and fin enhancements
Condenser tube and fin enhancements (except microchannel condensers)
Condenser hot gas defrost
Improved refrigerant piping

Component location
Alternative refrigeration systems
Improved VIPs

2. Technology Options

Through a review of each technology, DOE concluded in the preliminary analysis that all of the other identified technologies listed in section IV.A.2 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:

Table IV.2—Technologies Remaining in the Preliminary Analysis

Insulation
1. Improved resistivity of insulation (insulation type)
2. Increased insulation thickness
3. Gas-filled insulation panels
4. Vacuum-insulated panels

Gasket and Anti-Sweat Heat
5. Anti-sweat heat

Doors
6. Low-E coatings
7. Inert gas fill
8. Additional panes
9. Frame design

Compressor
10. Improved compressor efficiency
11. Variable-speed compressors

Evaporator
12. Forced-convection evaporator
13. Increased surface area
14. Multiple evaporators

Condenser
15. Increased surface area
16. Microchannel designs
17. Forced-convection condenser

Defrost System
18. Reduced energy for automatic defrost
19. Adaptive defrost
20. Off-cycle defrost

Control System
21. Electronic Temperature control
22. Air-distribution control

Other Technologies
23. Fan and fan motor improvements
24. Improved expansion valve
25. Alternative Refrigerants

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 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.

DOE received comments regarding the screened-out technologies; relevant comments are addressed.

AHAM agreed with DOE's decision to screen out solid doors as a technology option for the reason that ELs requiring solid doors will result in a significant loss in consumer utility. AHAM also agreed with DOE's decision to screen out Ultra-Low-E Glass Doors for similar reason, in that this technology also prevents the consumer from being able to see clearly into the cabinet. AHAM stated, should DOE include a door technology option in its final analysis for a possible amended standard, that analysis should provide careful justification to ensure that consumer utility and consumer costs are not unduly impacted. (AHAM, No. 18, p. 8)

The CA IOUs urged DOE to reconsider several technologies that they claimed were screened out of the analysis or improperly categorized. These technologies include ultra-low E glass doors, Inert Gas-Filled Glass, vacuum insulated glass, microchannel heat exchangers, and variable speed compressors. In considering ultra-low E glass doors, the CA IOUs request the DOE define an acceptable emissivity that does not significantly hinder visibility while providing energy savings. For inert gas-filled glass, the CA IOUs claim that triple-pane Argon-filled glass with low-e coating is widely available throughout the market and should be considered at lower ELs. Considering vacuum insulated glass, the CA IOUs point to several manufacturers offering the glass for refrigeration applications. Finally, the CA IOUs urged DOE to make more consideration into the implementation of microchannel heat exchangers and VSCs, claiming that their energy benefits were not fully considered in the preliminary analysis. (CA IOUs, No. 20, pp. 4–6)

DOE screened out ultra-low E glass panels due to loss in consumer utility associated with reduced visibility. DOE considers ultra-low E glass panels to be those with at least three glass layers and more than one low E coating. A large portion of the MREF market utilizes transparent glass doors as an option to allow the consumer to see inside the cooler compartment. Despite its ability to improve efficiency, ultra-low E glass reduces visibility into the cooler cabinet. In interviews, manufacturers specifically indicated that they avoid use of glass panels with more than one low E layer due to visibility concerns. DOE did include in its analysis triple-glazed panels with argon fill and one low E layer, consistent with panels that have been observed in available cooler products.

DOE likewise did not consider vacuum insulated glass as it impacts practicability of manufacture, repair, and installation. While it remains available as a technology option for use in refrigeration equipment (*e.g.,* walk-in cooler doors), DOE is not currently aware of vacuum-insulated glass currently in use for any MREFs. Also, because MREFs are typically much smaller than commercial refrigeration equipment, vacuum-insulated glass may not yet be available for all MREF sizes.

While the CA IOUs claim that five commercial refrigeration manufacturers already have integrated microchannel condenser coils in their equipment outside the MREF product category, DOE has not observed microchannel condensers in any of the products in the teardown analysis for MREFs. DOE notes that microchannel condensers may allow for refrigerant charge reductions and improved heat transfer but known drawbacks to these designs include irregular refrigerant distribution and greater pressure drops on the refrigerant side and air side. Therefore, microchannel condensers may not provide efficiency improvements. Hence, DOE screened out microchannel condensers as a technology option.

Variable speed compressors were included in the NOPR analysis and are implemented in higher-level ELs throughout the analyzed product classes. Published EER levels for VSCs are generally much higher than published EERs for single-speed compressors in the capacity range suitable for compact products, but DOE has not found many MREF products that use VSCs, nor many related compact refrigerators that use VSCs, and thus has little evidence on which to base confident predictions of large efficiency improvements. DOE received a range of estimates of the improvement potential associated with this technology from manufacturers during interviews. DOE believes that its MREF NOPR engineering analysis is representative of performance improvement potential using variable-speed compressors.

The door technology options that remain for increasing the efficiency of miscellaneous refrigeration products include low-e coatings, inert gas fills, additional panes, and frame design changes. Of these options, gas fills, additional panes, and low-e coating were the options implemented in the final EL analyses, with max-tech doors including triple-pane glass, argon gas fill, and a low-e layer on the outermost glass. These options were implemented based on their current use in the market.

DOE seeks further comment on any of the technologies screened out in this NOPR analysis as they were determined to not meet the screening criteria (*i.e.,* practicable to manufacture, install, and service and do not result in adverse impacts on consumer utility, product availability, health, safety, or use of unique-pathway proprietary technologies). DOE also seeks comment on those technologies retained for further consideration in the engineering analysis, based on the determination that they are technologically feasible and also meet the other screening criteria.

C. Engineering Analysis

The purpose of the engineering analysis is to establish the relationship between the efficiency and cost of miscellaneous refrigeration products. 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 products, DOE considers technologies and design option combinations not eliminated by the screening analysis. For each product class, DOE estimates the baseline cost, as well as the incremental cost for the product 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).

For the January 2022 Preliminary Analysis, DOE used the physical teardown approach supplemented with a catalog teardown approach for coolers. Several products from the cooler class (compact and standard size) and one product from the combination cooler class C–13A were used in physical teardowns. The physical teardown combination cooler was used to determine manufacturer production costs (''MPCs'') for one analyzed product class (C–13A), but that analysis primarily relied on the engineering conducted for the October 15, 2021, preliminary analysis for consumer refrigerators, refrigerator-freezers, and freezers (86 FR 57378) as the basis for other MPCs and incremental costs.

For this NOPR analysis, DOE chose to analyze classes C–3A and C–9 in addition to the original C–13A. Due to the lack of physical teardown products for these classes, the analysis relied heavily on adjusted analyses from the consumer refrigerators, refrigerator-freezers, and freezers (''RF'') classes 3 and 9. RF product class 3 represents refrigerator-freezers with automatic defrost with top-mounted freezers without an automatic icemaker while RF product class 9 represents upright freezers with automatic defrost without an automatic icemaker. Product class 3 was chosen as a proxy to C–3A due to its similar configuration, and its analysis was able to be adapted relatively easily. Likewise, C–9's analysis used RF product class 9's analysis due to similarities in configuration.[20] A survey approach was taken to determine sizing and pricing for representative models, and relevant design options from C–13A were used in the additional analyses. DOE also considered input provided during manufacturer interviews to improve upon design option energy savings and representative ELs.

General comments regarding the efficiency analysis are addressed below.

AHAM noted DOE builds its incremental MPC based on a set path of technology options, but there is no standard ordering of technology choice within a single company, let alone across the total industry. AHAM stated DOE should recognize there is limited new technology that would allow for significant per-unit reduction in energy consumption, particularly true of technology options that DOE evaluated to reach efficiency levels beyond EL 1. (AHAM, No. 18, pp. 6–7)

In response, DOE notes that the ordering of technologies is not intended to be aligned with the ordering that would be considered by a single company, nor is it intended to represent the ordering that the total industry would adopt. Instead, it is intended to provide reasonable representation, both of design options used by specific reverse-engineered products, and of an ordering that would prioritize the most cost-effective options, with gradual reductions in cost-effectiveness as the EL increases. Also, the certified data shows that existing products on the market demonstrate significant per-unit reduction in energy consumption. For example, among DOE's tested and reverse-engineered compact coolers was a 3.4 cuft cooler certified with energy use 45% less than the standard, and a 5.1 cuft cooler certified with energy use 49% less than the standard. These levels were EL3 for the preliminary analysis and beyond EL4 for the NOPR analysis, certainly beyond EL1. DOE test results confirmed that their energy use was consistent with the certifications.

CA IOUs stated that in its review of products currently available on the market, it was revealed that the incremental design options may not be the most appropriate (as presented by DOE in Table 5.5.1 of the preliminary TSD) as products on the market contain a combination of technologies DOE has attributed to different ELs. For example, smaller units within the compact category utilize efficiency features affecting the thermal envelope (argon and/or triple-pane glass), whereas larger units can utilize condenser, evaporator, and compressor efficiency features. (CA IOUs, No. 20, pp. 1–2)

When analyzing the models pointed to by CA IOUs, DOE was unable to confirm the efficiency level for one of the provided MREF models, due to the fact it was not listed on the Compliance Certification Database (''CCD'') as of August 2022. The compact model referred to above was located on the CCD system and rated at around 13% lower energy use than baseline; however, the model did not match the CCD rated AV, therefore, the efficiency information may not be up to date. Information regarding the design options used by each model was also limited, with relevant engineering design options absent from promotional

[20] As described in section IV.C.1.c of this document, DOE conducted engineering analysis for class C–9, but did not conduct further analysis due to the limited potential for efficiency increase.

material, user manuals, and specification sheets.

Considering the issues related to gathering information on the specific models referenced in the comment, DOE is unable to point to specific reasoning behind the design options implemented in each model. DOE does note, however, that it considers design options in a manner as described previously: with design options used by specific reverse-engineered products, and of an ordering that prioritizes the most cost-effective options for initial EL steps and gradual reduction in cost-effectiveness as the EL increases.

DOE requests any further input from commenters regarding the approach for design option selection and implementation for a given model, beyond the information DOE has already considered.

a. Built-In Classes

In this NOPR analysis, DOE chose to continue using freestanding MREF classes as proxies for built-in classes. DOE's analysis of the current market for miscellaneous refrigeration products showed built-in and freestanding products occupying the same range of efficiencies, and DOE did not identify any unique characteristic that would inhibit efficiency improvements for built-in products relative to freestanding products based on a review on the market. As a result, DOE chose to apply its freestanding products analyses to built-in classes. Several comments were received following the preliminary analysis (which used the same approach) and are addressed below.

According to AHAM, and echoed by Sub Zero and NEEA, freestanding product classes are not a good proxy for built-in product classes, and DOE should evaluate them separately. AHAM stated that DOE's assumption that the products can employ similar technology options in order to achieve higher efficiency levels is fundamentally flawed as built-in designs face difference constraints than freestanding designs. NEEA and Sub Zero both specifically mentioned insulation thickness increases and airflow as a major difference between built-in and freestanding products. (AHAM, No. 18, p. 9; Sub Zero, No. 17, p. 2; NEEA, No. 21, pp. 2–3)

Based on the comments provided, DOE revisited its review of the range of efficiency levels attainable by built-in and freestanding coolers. DOE noted that many products certified as freestanding have installation instructions that provide requirements for both freestanding and built-in installation and are advertised for both installations. DOE found that for such products, the majority of high-efficiency models are advertised as capable of both freestanding and built-in installations. For coolers between 2 and 6 cubic feet, DOE found that all of the most efficient products reviewed (roughly 37% better than baseline or more) were capable of both configurations, whereas some of the products that were less efficient in that adjusted volume range were advertised as freestanding only. This suggests that built-in products are not inhibited in their ability to achieve high efficiencies. For larger coolers between 14 and 16 cubic feet in adjusted volume, DOE found products up to 15% greater than the baseline level that were configurable in both, based on manufacturer instructions. There were a few large cooler products that reached the highest available efficiency reviewed, up to roughly 30% better than baseline, that are advertised as only capable of a freestanding configuration.

DOE also reviewed the depth of the various models considered to determine if models advertised for built-in installation have any clear dimensional limitation that might make achieving high efficiency levels more difficult. DOE was unable to determine a clear correlation between depth and energy use, for any of the models or capacity ranges considered, nor between depth and instructions or advertising for built-in installation. In fact, DOE found that the most efficient freestanding-only model in the large cubic volume range had the smallest depth of all the other models reviewed, suggesting that dimensional restriction on depth was not a key factor relative to the overall unit efficiency.

DOE also observed that the highest efficiency levels for coolers of the built-in class and efficiency levels for freestanding coolers having installation instructions or advertising for both freestanding and built-in installation were at or close to the maximum technology efficiency levels analyzed by DOE. DOE has not been provided evidence that manufacturers are using design options in built-ins other than those that have passed screening for this analysis. There are also no manufacturer comments that suggest other design options have been used to achieve max-tech efficiency levels in built-in products. Hence, DOE concludes built-ins are using the same set of design options as analyzed at max-tech for freestanding classes. Consequently, DOE did not conduct separate analysis for built-in classes.

While DOE chose, in this NOPR analysis, to continue using freestanding classes as proxies for built-in classes, DOE requests additional information regarding the constraints for built-in designs relative to freestanding designs, and the associated specific efficiency and cost impacts.

b. Baseline Efficiency/Energy Use

For each product/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 product/equipment class represents the characteristics of a product/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.

For the January 2022 Preliminary Analysis, DOE chose baseline efficiency levels represented by the current Federal energy conservation standards, expressed as maximum annual energy consumption as a function of the product's adjusted volume. The baseline levels differ for coolers and combination coolers to account for design differences; all coolers share the same baseline level, *i.e.,* the baseline is the same function of adjusted volume for both freestanding and built-in models, for both compact and standard-size models.

For this NOPR, DOE kept the cooler baselines the same as the preliminary analysis; the combination cooler baseline has also been kept the same. From these baselines DOE conducted direct analyses for three different AV coolers, and two combination coolers (C–13A, and C–3A). In conducting these analyses, eight teardown units were used in construction of cost curves, and had their characteristics determined in large part by testing and reverse-engineering. Further information on the design characteristics of specific analyzed baseline models is summarized in the NOPR TSD.

c. Higher Efficiency Levels

For the NOPR analysis, DOE analyzed up to five incremental efficiency levels beyond the baseline for each of the analyzed product classes. The efficiency levels start at EL1, 10% more efficient than the current energy conservation standard. For the compact coolers NOPR analysis, DOE extended the efficiency levels in steps of 10% of the current energy conservation standard up to EL 4; for full-size coolers, EL 4 is analyzed at 35%. For combination coolers (excluding C–9) efficiency levels above EL 1 are in steps of 5% up to EL 4.

Finally, EL 5 represents maximum technology (''max-tech''), using design option analysis to extend the analysis beyond EL 4 using all applicable design options, including max efficiency variable-speed compressors, and maximum practical use of VIPs. For coolers, the current Energy Star specifications correspond to EL 1 for freestanding full-size coolers (10%), EL 2 for freestanding compact coolers (20%), and EL 3 for both classes of built-in coolers (30%).

DOE conducted analysis for product class C–9 starting with analysis for a class 9 upright freezer with comparable total refrigerated volume. In its analysis, DOE concluded that application of all of the design options being considered at max-tech would be required for the product to be compliant with the current energy conservation standards. Currently, the CCD includes only one product that is certified as C–9—an LG product certified with energy use 17% below the standard. DOE did not purchase, test, and reverse-engineer this product, in-part because of the limited product offering and expected insignificant potential for energy savings for the class. Thus, DOE is relying primarily on its analysis of the RF product class 9 freezer, to suggest that opportunities for energy savings are likely limited and likely not cost-effective, even if improved efficiency is technically feasible. DOE has not analyzed efficiency levels beyond baseline for this product class in this NOPR, but has taken into consideration all design options applied at max-tech in its analysis.

DOE received comments regarding intermediate efficiency levels as shown below.

The CA IOUs expressed concern that the cost analysis performed in the preliminary TSD is overly conservative; the marked drop in calculated benefits between the lower ELs does not accurately reflect the more nuanced state of the market. As such, they suggested DOE implement an intermediate EL, between EL 1 and EL 2, for the Cooler-FC and Cooler-F product classes. They also suggested an intermediate EL between EL 2 and EL 3 for product class C–13A. NEEA voiced similar concerns to CA IOUs and also suggested similar intermediate EL levels for coolers and C–13A. ASAP also urged DOE to consider an intermediate EL for compact coolers between ELs 1 and 2. (CA IOUs, No. 20, pp. 1–2; NEEA, No. 21, pp. 5–6; ASAP, No. 19, pp. 2–3)

In response, DOE notes that the efficiency levels considered in the NOPR analysis differ significantly from those considered in the January 2022 Preliminary Analysis.[21] While all of the specific gap fill levels suggested by stakeholders may not have been included, DOE believes that, the levels suggested in this NOPR more accurately reflect the full efficiency range of the market. The proposed EL steps have been chosen to represent the full range of efficiency and reflect the products on the market for each product class.

ASAP noted, in the preliminary TSD for consumer refrigerators and freezers, DOE estimated a 9-percent improvement in compressor efficiency associated with converting from a single-speed compressor to a VSC with similar rated energy efficiency ratio (''EER'') values, and ASAP stated they expect there to be similar savings for compact coolers. ASAP further noted, however, in the preliminary analysis for the 5.1 cubic foot compact cooler representative unit, DOE appears to show energy savings of only about 2 percent when going from the most efficient single-speed compressor at EL 3 to a VSC and a triple-pane glass pack at EL 4. ASAP therefore stated concern that DOE may be underestimating the energy savings associated with the design options incorporated at EL 4 and urged DOE to ensure that its analysis is appropriately capturing the savings from the incorporation of a VSC. (ASAP, No. 19, p. 2)

When constructing a direct analysis of the 5.1 cubic foot compact cooler DOE considered numerous design options when moving from EL 3 to EL 4. The effect of the triple-pane glass and switch to VSC alone do not contribute to the ultimate percentage difference between El 3 and EL 4. DOE has continued to work with manufacturers in order to accurately create ELs for both coolers and combination coolers that are based on real-world information and energy consumption.

The efficiency levels analyzed for this NOPR beyond the baseline are shown in Table IV.3.

TABLE IV.3—INCREMENTAL EFFICIENCY LEVELS FOR ANALYZED PRODUCTS (% ENERGY USE LESS THAN BASELINE)

Product class (AV, cu.ft.)	Coolers			Combination coolers	
	FCC (3.1) (%)	FCC (5.1) (%)	FC (15.3) (%)	C–13A (5) (%)	C–3A (21) (%)
EL 1	10	10	10	10	10
EL 2*	20	20	20	16	15
EL 3	30	30	30	20	20
EL 4	40	40	35	25	24
EL 5	59	50	38	28	30

* ENERGY STAR % level varies based on specific teardown units analyzed.

d. VIP and VSC Analysis

DOE received comments on the implementation of VIPs in its analyses, and the comments are addressed below.

AHAM stated DOE does not account for the limitations of VIPs and that DOE's modeling does not apply VIPs as they would likely be used in actual products and, as a result, overestimates their use and impact in its analysis. AHAM stated DOE should note the following when evaluating the effectiveness of VIPs: covering all sides of an MREF casing in VIPs is not reasonable or a good design practice, there are costs associated with VIPs beyond the price of the panels themselves, a failed VIP in the field cannot be repaired and it will require a total product replacement, and VIPs are not effective for smaller products because of ''edge effects.'' AHAM stated DOE should further discuss these issues with manufacturers during manufacturer interviews and evaluate more products in order to get a better understanding of the complexities and costs associated with VIPs and update its analysis accordingly. (AHAM, No. 18, pp. 7–8)

[21] The January 2022 Preliminary Analysis TSD presenting the preliminary analysis is available at: *www.regulations.gov/document/EERE-2020-BT-STD-0039-0009.*

In communicating with manufacturers DOE received similar comments relating to decreased effectiveness of VIPs on miscellaneous refrigeration products. For the NOPR analysis DOE aimed to adjust the usage of VIPs in order to provide more accuracy in associated energy savings. More focus was put on increasing efficiency in glass panels, gas fills, and thickness changes when moving up in efficiency levels. Only partial VIP coverage was included in max-tech levels for the NOPR analysis.

ASAP expressed concern that DOE is underestimating the potential savings from upgrading from a single-speed compressor to a VSC by not accounting for the higher EER values of VSCs. ASAP noted that, in the preliminary TSD, DOE states compressors typically present in MREFs have capacities of 300 to 400 Btu per hour, but at a capacity of 300 BTU per hour, for example, even the least efficient VSC has a higher EER than the most efficient single-speed compressor. ASAP further noted that the EER of the most efficient VSC at 300 BTU per hour appears to be about 30 percent higher than the most efficient single-speed compressor. ASAP therefore urged DOE to ensure that its analysis is capturing the improved full-load efficiency of VSCs relative to single-speed compressors. (ASAP, No. 19, p. 1)

In the preliminary analysis, as laid out in figure 5.5.1 in the preliminary TSD, DOE analyzed the capacity and efficiency ratings of numerous VSCs through publicly available compressor performance data. 79 FR 71705. This figure does show that VSCs account for a higher EER when compared to single-speed compressors as capacity (Btu/h) is decreased. However, relating back ASAP's claim relating to 300 Btu/h capacity compressors, manufacturer feedback indicates that these EER efficiency increases are not generally realized when implementing this technology. Manufacturers have reported a wide range of overall efficiency increases associated with use of variable-speed compressors. In in the NOPR analysis DOE considered manufacturer feedback regarding experience with implementing VSC's in order to avoid overestimating efficiency increases. The analysis primarily considers energy savings associated with increased heat exchanger effectiveness associated with lower compressor speed operation and reduced fan speeds, assuming that fans would be operated at reduced speed when operating at low compressor speed. VSCs are generally implemented at higher EL levels throughout the analysis, consistent with their projected cost effectiveness.

DOE seeks comment on the range of VSC nominal efficiencies and the relative overall efficiency gains offered by VSCs when operating at reduced compressor speeds along with reduced fan speeds in MREF products.

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, the availability and timeliness of purchasing the product 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.

☐ *Catalog teardowns:* In lieu of physically deconstructing a product, DOE identifies each component using parts diagrams (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 primarily physical teardowns. Physical teardowns were used to provide a baseline of technology options and their pricing for a specific product class at a specific EL level. Then with technology option information, DOE estimated the cost of various design options including compressors, VIPs, and insulation, by extrapolating the costs from price surveys of relevant refrigerators, refrigerator-freezers, and freezers.

AHAM stated VSC supply is not sufficient to accommodate a standard that requires their use for all MREF products, indicating that this will drive up costs, and further noting that DOE's analysis does not account for these increased costs. AHAM also stated MREFs are enclosed systems and the use of VSCs entails significant redesign costs for those that do not currently employ VSCs, which DOE's analysis also must account for. (AHAM, No. 18, p. 8)

DOE has considered the comments regarding VSC availability and cost of VSC implementation. For this NOPR analysis, DOE estimated the cost of implementing VSCs based on the costs of relevant variable-speed compressors available on the market for other refrigeration products. Regarding component availability, DOE acknowledges that more stringent standards would likely necessitate adoption of more efficient technologies, such as variable-speed compressors. However, DOE expects that standards, if adopted, would provide sufficient time and regulatory certainty for manufacturers and suppliers to establish additional capacity in the supply chain, if needed. Should this NOPR proceed to a final rule, compliance with any amended standards would not be required until 5-years after a final rule is published. DOE expects that this 5-year compliance period provides adequate time for OEMs to sign supply contracts with their compressor suppliers ahead of anticipated demand.

DOE seeks comment on whether manufacturers expect manufacturing capacity constraints would limit product availability to consumers in the timeframe of the amended standard compliance date.

3. Cost-Efficiency Results

The results of the engineering analysis are presented as cost-efficiency data for each of the efficiency levels for each of the product classes that were analyzed, as well as those extrapolated from a product class with similar cooling capacity and features. DOE developed estimates of MPCs for each unit in the teardown sample, and also performed additional modeling for each of the teardown samples, to develop a comprehensive set of MPCs at each efficiency level. The resulting weighted average incremental MPCs (*i.e.,* the additional costs manufacturers would likely incur by producing miscellaneous refrigeration products at each efficiency level compared to the baseline) are provided in Tables 5.5.5 and 5.5.6 in chapter 5 of the NOPR TSD. See chapter 5 of the NOPR TSD for additional detail on the engineering analysis.

DOE seeks comment on the method for estimating manufacturing production costs and on the resulting cost-efficiency curves.

See section VII.E of this document for a list of issues on which DOE seeks comment.

TABLE IV.1—INCREMENTAL DESIGN OPTIONS * BY EFFICIENCY LEVEL AND PRODUCT CLASS

Product class (AV ***)		EL1	EL2	EL3	EL4	EL5
FCC (3.1).	EL Percent	10%	20%	30%	40%	59%.
	Design Options Added	Tube and Fin Evaporator; Argon Filled Glass.	Static Condenser;	Higher-EER Compressor; Tube and Fin Condenser.	Variable-Speed Compressor; Roll Bond Evaporator; Manual Defrost; Increased Insulation Thickness.	Partial VIP; Triple Pane Glass **; Tube and Fin Bond Evaporator.
FCC (5.1).	EL Percent	10%	20%	30%	40%	50%.
	Design Options Added	Argon Filled Glass; Higher-EER Compressor.	Higher-EER Compressor.	Higher-EER Compressor; Hot Wall Condenser.	Higher-EER Compressor; Tube and Fin Evaporator; HotWall + Tube and Fin Condenser; Increased Insulation Thickness.	Variable-Speed Compressor; Partial VIP; Triple Pane Glass **.
FC (15.3)	EL Percent	10%	20%	30%	35%	38%.
	Design Options Added	Higher-EER Compressor; Hot Wall + Tube and Fin Condenser.	Higher-EER Compressor.	Variable-Speed Compressor; Variable Defrost; 3x Tube and Fin Evaporator; Increased Insulation Thickness.	Triple Pane Glass **	Partial VIP.
C–13A (5).	EL Percent	10%	16%	20%	25%	28%.
	Design Options Added	Higher-EER Compressor.	Higher-EER Compressor.	Variable-Speed Compressor.	Triple Pane Glass **	Partial VIP.
C–3A (20.6).	EL Percent	10%	15%	20%	24%.	
	Design Options Added	Higher-EER Compressor.	Variable-Speed Compressor; Variable (off-cycle) Defrost.	Triple Pane Glass**; Timed (off-cycle) Defrost; Higher-EER Variable Speed Compressor.	Partial VIP; Variable (off-cycle) Defrost.	

* Design options are cumulative between efficiency levels (except for component replacements).
** Triple-pane glass pack consists of soft-coated low-E glass and argon gas fill (with a reduced gap size to maintain door thickness).
*** AV represented in ft^3.

TABLE IV.2—COST-EFFICIENCY CURVES FOR MISCELLANEOUS REFRIGERATION PRODUCTS

Product Class (AV *)		EL0	EL1	EL2	EL3	EL4	EL5
FCC (3.1)	EL Percent	0%	10%	20%	30%	40%	59%
	MPC	$273.66	$289.88	$299.61	$309.88	$343.55	$392.74
	Incremental MPC	$0.00	$16.21	$25.94	$36.22	$69.88	$119.08
FCC (5.1)	EL Percent	0%	10%	20%	30%	40%	50%
	MPC	$307.76	$310.89	$313.29	$327.72	$354.18	$439.26
	Incremental MPC	$0.00	$3.13	$5.53	$19.96	$46.42	$131.50
FC (15.3)	EL Percent	0%	10%	20%	30%	35%	38%
	MPC	$648.22	$661.71	$665.13	$709.87	$832.95	$845.25
	Incremental MPC	$0.00	$13.49	$16.91	$61.65	$184.72	$197.02
C–13A (5)	EL Percent	0%	10%	15%	20%	25%	28%
	MPC	$533.25	$535.25	$537.01	$565.74	$589.63	$627.33
	Incremental MPC	$0.00	$2.00	$3.76	$32.48	$56.37	$94.07
C–3A (20.6)	EL Percent	0%	10%	16%	20%	24%	
	MPC	$601.00	$604.17	$639.47	$733.13	$790.03	
	Incremental MPC	$0.00	$3.17	$38.47	$132.13	$189.03	
C–9 (20) **	EL Percent	0%					
	MPC	$514.16					
	Incremental MPC	$0					

* Adjusted volumes provided in ft^3.
** Only considered at baseline.

4. Manufacturer Selling Price

To account for manufacturers' non-production costs and profit margin, DOE applies a multiplier (the manufacturer markup) to the MPC. The resulting manufacturer selling price (''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 (''SEC'') 10–K reports [22] filed by publicly-traded manufacturers primarily engaged in appliance manufacturing and whose combined product range includes miscellaneous refrigeration products. See chapter 12 of the NOPR TSD for additional detail on the manufacturer markup.

[22] U.S. Securities and Exchange Commission, *Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system.* Available at *www.sec.gov/edgar/search/* (last accessed September 22, 2022).

D. Markups Analysis

The markups analysis develops appropriate markups (*e.g.,* retailer markups and distributor markups) in the distribution chain and sales taxes to convert the MSP 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 markup equipment prices to cover business costs and profit margin.

For MREFs, DOE identified two distribution channels: (1) manufacturers to retailers to consumers, and (2) manufactures to wholesalers to dealers/retailers to consumers. The parties involved in the distribution channel are retailers, wholesalers and dealers.

DOE developed baseline and incremental markups for each actor in the distribution channel. Baseline markups are applied to the price of products 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.

DOE relied on economic data from the U.S. Census Bureau to estimate average baseline and incremental markups. Specifically, DOE used the 2017 Annual Retail Trade Survey for the ''electronics and appliance stores'' sector to develop retailer markups, and the 2017 Annual Wholesale Trade Survey for the ''household appliances, and electrical and electronic goods merchant wholesalers'' sector to estimate wholesaler markups. DOE recognized that the overall markup in the wholesaler channel should be higher than the direct retailer channel. Considering that most of the wholesalers and dealers/retailers hold special contract in the wholesaler channel, DOE assumed that the dealer/retailer markups are half of the values of the retailer makeups in the direct retailer channel.

DOE requests comment on the assumption used in developing the dealer/retailer markups and welcomes any feedback on the overall markup in the wholesaler channel.

Chapter 6 of the NOPR TSD provides details on DOE's development of markups for MREFs.

E. Energy Use Analysis

The purpose of the energy use analysis is to determine the annual energy consumption of MREFs at different efficiencies in representative U.S. households, and to assess the energy savings potential of increased MREF efficiency. The energy use analysis estimates the range of energy use of MREFs in the field (*i.e.,* as they are actually used by consumers). 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.

DOE determined a range of annual energy use of MREFs as a function of unit volume. DOE developed distributions of adjusted volume of product classes (Table IV.3) with more than one representative unit base on the capacity distributions reported in the TraQline® wine chiller data spanning from 2020 Q1 to 2022 Q1.[23] [24] DOE also developed a sample of households that use MREFs based on the TraQline wine chiller data (see section IV.G for details). For each volume and considered efficiency level, DOE derived the energy consumption as measured by the DOE test procedure at 10 CFR part 430, subpart B, appendix A, with the exception that DOE used in its analysis the reduced icemaker energy use contribution that would take effect on the compliance date of new standards.

DOE requests comment on its methodology to develop market share distributions by adjusted volume in the compliance year for each product class with two representative volumes, as well as data to further inform these distributions in subsequent rounds of this rulemaking.

TABLE IV.3—DISTRIBUTION OF ADJUSTED INTERIOR VOLUMES BY PRODUCT CLASS

Adjusted volume (ft^3)	Percentage
FCC	
3.1	83.4
5.1	16.6
BICC	
3.1	81.3
5.1	18.7
FC and BIC	
15.3	100.0
C–3A	
21	100.0
C–9	
20	100.0
C–13A	
5	100.0

[23] TraQline is a market research company that specialized in tracking consumer purchasing behavior across a wide range of products using quarterly online surveys.

[24] DOE acknowledges that the pandemics which span the sample period may contribute to the medium- to long-term consumer behavior changes. DOE will continue monitor the consumer behavior trend and may make alternative estimation in the next rulemaking phase.

Chapter 7 of the NOPR TSD provides details on DOE's energy use analysis for MREFs.

F. Life-Cycle Cost and Payback Period Analysis

DOE conducted the LCC and PBP analyses to evaluate the economic impacts on individual consumers of potential energy conservation standards for MREFs. 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 MREFs 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.

NEEA encouraged DOE to calculate and consider the return on investment

(ROI) for each efficiency level as an additional metric of cost-effectiveness, which would only require the use of simple payback and device lifetime. (NEEA, No. 21, pp. 6–7).

DOE acknowledges that ROI is a metric that can be useful in evaluating investments in energy efficiency. However, the measures that DOE has historically used to evaluate the economic impacts of standards on consumers—LCC savings and PBP—are more closely related to the language in EPCA that requires DOE to consider the savings in operating costs throughout the estimated average life of the covered product 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 product that are likely to result from a standard. (42 U.S.C. 6295(o)(2)(B)(i)(II)) Therefore, DOE finds it reasonable to continue to use those measures.

For each considered efficiency level in each product class, DOE calculated the LCC and PBP for a nationally representative set of housing units. As stated previously, DOE developed household samples based on TraQline wine chiller survey data. The survey panel is weighted against the U.S. Census based on their demographic characteristic to make the sample representative of the U.S. population. The wine chiller survey asked respondents about the product features of the wine chillers they recently purchased, as well as the purchasing channel of the products. To account for the more recent MREF consumers, DOE used the latest two years of survey data (2020 Q1 to 2022 Q1) to construct the household sample used in this NOPR.[25]

For each sample household, DOE determined the energy consumption for the MREF(s) and the appropriate energy price. By developing a representative sample of households, the analysis captured the variability in energy consumption and energy prices associated with the use of MREFs.

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 (if applicable), 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 and PBP 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 MREF user samples. The model calculated the LCC and PBP for products at each efficiency level for 10,000 housing units per simulation run. The analytical results include a distribution of 10,000 data points 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 and PBP 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 all consumers of MREFs as if each were to purchase a new product in the expected year of required compliance with new or amended standards. New and amended standards would apply to MREFs manufactured 5 years after the date on which any new or amended standard is published. (42 U.S.C. 6295(l)(2)) At this time, DOE estimates publication of a final rule in 2024. Therefore, for purposes of its analysis, DOE used 2029 as the first year of compliance with any amended standards for MREFs.

Table IV.4 summarizes the approach and data DOE used to derive inputs to the LCC and PBP calculations. The paragraphs 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.4—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	Assumed no change with efficiency level. Not considered in the analysis.
Annual Energy Use	Derived from engineering inputs (See chapter 5 of the NOPR TSD). *Variability:* Based on the product class and rep unit volume, where applicable.
Energy Prices	*Electricity:* Based on 2021 average and marginal electricity price data from the Edison Electric Institute. *Variability:* Electricity prices vary by region.
Energy Price Trends	Based on *AEO 2022* price projections.
Repair and Maintenance Costs	Assumed no change with efficiency level. Not considered in the analysis.
Product Lifetime	*Average:* 12.6 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	2029.

* 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.

[25] DOE acknowledges that the pandemics which span the sample period may contribute to the medium- to long-term consumer behavior changes. DOE will continue monitor the consumer behavior trend and may make alternative estimation in the next rulemaking phase.

1. Product 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 products, because DOE applies an incremental markup to the increase in MSP associated with higher-efficiency products.

Economic literature and historical data suggest that the real costs of many products may trend downward over time according to ''learning'' or ''experience'' curves. Experience curve analysis implicitly includes factors such as efficiencies in labor, capital investment, automation, materials prices, distribution, and economies of scale at an industry-wide level.[26] In the experience curve method, the real cost of production is related to the cumulative production or ''experience'' with a manufactured product. DOE used historical Producer Price Index (PPI) data for ''household refrigerator and home freezer manufacturing'' from the Labor Department's Bureau of Labor Statistics' (''BLS'') spanning the time period between 1989 and 2021 as a proxy of the production cost for MREFs.[27] This is the most relevant price index for MREFs as the main technology options are similar to full-size refrigerators and several refrigerator manufacturers also produce MREFs. An inflation-adjusted price index was calculated by dividing the PPI series by the gross domestic product index from Bureau of Economic Analysis for the same years. The cumulative production of MREFs were assembled from the estimated annual shipments using the stock accounting approach between 2016 and 2021, and a flat shipment trend was assumed prior to 1951. The estimated learning rate (defined as the fractional reduction in price expected from each doubling of cumulative production) is 15.5 ± 1.7 percent.

DOE included variable-speed compressors as a technology option for higher efficiency levels. To develop future prices specific for that technology, DOE applied a different price trend to the controls portion of the variable-speed compressor, which represents part of the price increment when moving from an efficiency level achieved with the highest efficiency single-speed compressor to an efficiency level with variable-speed compressor. DOE used PPI data on ''semiconductors and related device manufacturing'' between 1967 and 2021 to estimate the historic price trend of electronic components in the control.[28] The regression, performed as an exponential trend line fit, results in an R-square of 0.99, with an annual price decline rate of 6.3 percent. See chapter 8 of the TSD for further details on this topic.

AHAM noted that any declining costs are due to value engineering and/or productivity improvements, and agreed with DOE's decision not to use a price learning curve in the preliminary analysis. AHAM also stated that MREFs are not identical to refrigerators and freezers, and therefore DOE should not apply the learning curve from the refrigerators, refrigerator-freezers, and freezers rulemaking analysis. (AHAM, No. 18, p. 6) On the other hand, NEEA, ASAP and the CA IOUs, encouraged DOE to incorporate a price learning curve. ASAP and the CA IOUs expressed concern that assuming constant prices will result in overestimating the cost to achieve higher efficiency levels in the assumed compliance year and beyond and suggested the use of price data from consumer refrigerators to inform the development of an appropriate learning rate for MREFs, as many of the same design options are used for MREFs. (NEEA, No. 21, pp. 4–5, ASAP, No. 19 at p. 3, CA IOUs, No. 20, pp. 2–4).

As discussed earlier, in this NOPR DOE developed a price learning based on the historical refrigerator and freezer PPI and the cumulative production estimated specifically for MREFs, assuming that the refrigerator and freezer PPI is representative of MREFs. Given that similar design options are considered for units in higher efficiency levels as for consumer refrigerators, DOE also considered a separate price learning for the controls portion of the variable-speed compressor in MREFs at higher efficiency levels. DOE is requesting comment on this approach.

2. Installation Cost

Installation cost includes labor, overhead, and any miscellaneous materials and parts needed to install the product. DOE is not aware of any data that suggest the cost of installation changes as a function of efficiency for MREFs. DOE therefore assumed that installation costs are the same regardless of EL and do not impact the LCC or PBP. As a result, DOE did not include installation costs in the LCC and PBP analysis.

3. Annual Energy Consumption

DOE determined the energy consumption for MREFs at different efficiency levels using the approach described previously in section IV.E of this document.

4. 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 2021 using data from EEI Typical Bills and Average Rates reports. 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 residential sector, DOE calculated electricity prices using the methodology described in Coughlin and Beraki (2018).[29]

To estimate energy prices in future years, DOE multiplied the 2021 energy prices by the projection of annual average price changes from the Reference case in *AEO 2022,* which has an end year of 2050.[30] To estimate price trends after 2050, DOE used the 2050 electricity prices, held constant.

5. 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 produce no, or only minor, changes in repair and maintenance costs compared to baseline efficiency

[26] Taylor, M. and Fujita, K.S. Accounting for Technological Change in Regulatory Impact Analyses: *The Learning Curve Technique.* LBNL–6195E. Lawrence Berkeley National Laboratory, Berkeley, CA. April 2013. *http://escholarship.org/uc/item/3c8709p4#page-1.*

[27] Household refrigerator and home freezer manufacturing PPI series ID: PCU3352203352202; *www.bls.gov/ppi/.*

[28] Semiconductors and related device manufacturing PPI series ID: PCU334413334413; *www.bls.gov/ppi/.*

[29] Coughlin, K. and B. Beraki.2018. Residential Electricity Prices: A Review of Data Sources and Estimation Methods. Lawrence Berkeley National Lab. Berkeley, CA. Report No. LBNL–2001169. *https://ees.lbl.gov/publications/residential-electricity-prices-review* (Last accessed September 22, 2022).

[30] EIA. *Annual Energy Outlook 2022 with Projections to 2050.* Washington, DC. Available at *www.eia.gov/forecasts/aeo/* (last accessed September 22, 2022).

products. DOE is not aware of any data that suggest the cost of repair or maintenance for MREFs changes as a function of efficiency. DOE therefore assumed that these costs are the same regardless of EL and do not impact the LCC or PBP. As a result, DOE did not include maintenance and repair costs in the LCC and PBP analysis.

6. Product Lifetime

For MREFs, DOE used lifetime estimates from products that operate using the same refrigeration technology: covered refrigerators and refrigerator-freezers. DOE assumed a maximum lifetime of 40 years for all product classes and an average lifetime of 10.3 years for compact coolers and 17.3 years for full-size coolers. DOE also assumed that the probability function for the annual survival of MREFs would take the form of a Weibull distribution. See chapter 8 of the NOPR TSD for a more detailed discussion.

DOE requests comment and data on the assumptions and methodology used to calculate MREF survival probabilities.

7. Discount Rates

In the calculation of LCC, DOE applies discount rates appropriate to households to estimate the present value of future operating cost savings. DOE estimated a distribution of residential discount rates for MREFs based on consumer financing costs and the opportunity cost of consumer funds.

DOE applies weighted average discount rates calculated from consumer debt and asset data, rather than marginal or implicit discount rates.[31] The LCC analysis estimates net present value over the lifetime of the product, so the appropriate discount rate will reflect the general opportunity cost of household funds, taking this time scale into account. Given the long-time horizon modeled in the LCC analysis, the application of a marginal interest rate associated with an initial source of funds is inaccurate. Regardless of the method of purchase, consumers are expected to continue to rebalance their debt and asset holdings over the LCC analysis period, based on the restrictions consumers face in their debt payment requirements and the relative size of the interest rates available on debts and assets. DOE estimates the aggregate impact of this rebalancing using the historical distribution of debts and assets.

To establish residential discount rates for the LCC analysis, DOE identified all relevant household debt or asset classes in order to approximate a consumer's opportunity cost of funds related to appliance energy cost savings. It estimated the average percentage shares of the various types of debt and equity by household income group using data from the Federal Reserve Board's Survey of Consumer Finances (SCF) for 1995, 1998, 2001, 2004, 2007, 2010, 2013, 2016, and 2019.[32] Using the SCF and other sources, DOE developed a distribution of rates for each type of debt and asset by income group to represent the rates that may apply in the year in which amended standards would take effect. DOE assigned each sample household a specific discount rate drawn from one of the distributions. The average rate across all types of household debt and equity and income groups, weighted by the shares of each type, is 4.1 percent. See chapter 8 of the NOPR TSD for further details on the development of consumer discount rates.

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

To accurately 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).

In the January 2022 Preliminary Analysis, DOE estimated the energy efficiency distribution of MREFs for 2029 using model counts from DOE's CCD. DOE assumed that the distribution of models was equivalent to the distribution of products sold. AHAM commented that the distribution DOE obtained through this approach did not reflect the shipment breakdown by efficiency seen in the market and submitted shipment data by product class and efficiency level collected from its members to illustrate the discrepancy between the CCD data and the AHAM efficiency distributions. (AHAM, No. 18, p. 2–5)

DOE appreciates AHAM's data submission and, for this NOPR, DOE is using the efficiency distribution by product class as provided by AHAM. DOE understands that this approach inherently assumes that the rest of the MREF market has a similar distribution of efficiencies. However, due to lack of efficiency data from non-AHAM members, DOE is not able to verify whether this assumption is incorrect. For this analysis, DOE also assumed that the current distribution of product efficiencies would remain constant in 2029, and during the analysis period, in the no-new-standards case.

The estimated market shares for the no-new-standards case for MREFs are shown in Table IV.5 of this document. See chapter 8 of the NOPR TSD for further information on the derivation of the efficiency distributions.

TABLE IV.5—EFFICIENCY DISTRIBUTIONS FOR THE NO-NEW-STANDARDS CASE IN THE COMPLIANCE YEAR

Product class	Total adjusted volume (cu. ft.)	2029 Market share (%)						
		EL 0	EL 1	EL 2	EL 3	EL 4	EL 5	Total*
Cooler-FC	3.1 5.1	79	18	3	0	0	0	100
Cooler-BIC	3.1 5.1	18	6	1	1	0	74	100
Cooler-F	15.3	42	58	0	0	0	0	100
Cooler-BI	15.3	72	8	20	0	0	0	100
C–13A	5	99	1	0	0	0	0	100
C–3A	21	100	0	0	0	0	....	100

*The total may not sum to 100% due to rounding.

[31] The implicit discount rate is inferred from a consumer purchase decision between two otherwise identical goods with different first cost and operating cost. It is the interest rate that equates the increment of first cost to the difference in net present value of lifetime operating cost, incorporating the influence of several factors: transaction costs; risk premiums and response to uncertainty; time preferences; interest rates at which a consumer is able to borrow or lend. The implicit discount rate is not appropriate for the LCC analysis because it reflects a range of factors that influence consumer purchase decisions, rather than the opportunity cost of the funds that are used in purchases.

[32] U.S. Board of Governors of the Federal Reserve System. Survey of Consumer Finances. 1995, 1998, 2001, 2004, 2007, 2010, 2013, 2016, and 2019. (Last accessed September 22, 2022.) *http://www.federalreserve.gov/econresdata/scf/scfindex.htm.*

DOE requests comment and data on its efficiency distribution assumptions and projection into future years. Specifically, DOE is requesting comment and data on the efficiency distribution of non-AHAM members, to more accurately derive the efficiency distribution for the whole MREF market.

9. Payback Period Analysis

The payback period is the amount of time it takes the consumer to recover the additional installed cost of more-efficient products, compared to baseline products, through energy cost savings. Payback periods are expressed in years. Payback periods 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. The PBP calculation uses the same inputs as the LCC analysis, except that discount rates are not needed.

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 of purchasing a product complying with an energy conservation standard level 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. (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.[33] The shipments model takes an accounting approach, tracking market shares of each product 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.

DOE defined two broad MREF product categories (coolers, and combination cooler refrigeration products) and developed models to estimate shipments for each category. DOE used various data and assumptions to develop the shipments for each product class considered in this rulemaking.

Given the limited available data sources on historical shipments of coolers, DOE assumed a penetration rate of 13.3 percent in the U.S. households based on online surveys[34] to estimate the annual shipments starting from 2016, the start year of *AEO 2022* housing projection data.[35 36] DOE multiplied the estimated penetration by the total number of households from the *AEO 2022,* and then determined the number of new shipments by dividing the total stock by the mean product lifetime. DOE projected the annual shipments by incorporating the lifetime distributions by product class and assuming that the growth of new sales is consistent with the housing projections from *AEO 2022.* To estimate shipments prior to 2016, DOE assumed a flat historical shipment trend at the 2016 level. With even more limited available data sources on historical shipments of combination cooler refrigeration products, DOE estimated total shipments of combination cooler refrigeration products in 2014 to be 36,000 units, based on feedback from manufacturers from the October 2016 Direct Final Rule. DOE assumed sales would increase in line with the increase in the number of households in *AEO 2022.* Finally, DOE incorporated the 2021 shipment data provided by AHAM to re-calibrate total shipments for each product class considered in this rulemaking.

AHAM commented that the methodology DOE used to develop shipments in the preliminary analysis was based on findings of a Lawrence Berkeley National Laboratory (''LBNL'') study taken place nine years ago and that DOE should improve its data collection effort and consider other data sources. AHAM conducted another data collection among its members for 2021 shipments by product class in response to DOE's comment regarding AHAM shipments from the RFI (AHAM, No. 18 at p. 2–5). A separate confidential shipment data submission disaggregated by product class and capacity was provided by AHAM along with its comment.

AHAM stated that the data they provided for 2021 shipments by product class and efficiency varies substantially from the data and assumptions in DOE's aforementioned shipments analysis (AHAM, No. 18 at p. 2). Furthermore, AHAM asserted that the bulk of the market lies at lower efficiency levels, its membership represents a majority of the market, and shipments are significantly lower than what DOE is projecting. Finally, AHAM noted that DOE should further investigate other data sources to collect accurate information from non-AHAM members (including NPD,[37] TraQline data, and manufacturer interviews) rather than relying on calculations whose assumptions may not be accurate. Sub Zero echoed AHAM's comments and suggested DOE rethink its approach using manufacturer-provided data (Sub Zero, No. 17 at p. 2).

DOE appreciates the shipments data submitted by AHAM, which were disaggregated by product class and efficiency. As discussed earlier in this NOPR, DOE used the efficiency distributions by product class to match those submitted by AHAM. DOE also assumed that the market share of each product class (in relation to the total MREF shipments) matched the market shares provided by AHAM. To estimate total MREF shipments, DOE utilized the AHAM shipments data and AHAM-member information and reviewed the TraQline data from 2020 Q1 to 2022 Q1 to estimate non-AHAM-member

[33] 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.

[34] DOE also reviewed the recent release of the EIA 2020 Residential Energy Consumption Survey (RECS 2020), which identified wine chillers in representative U.S. households. DOE found that the penetration rate of wine chillers in RECS 2020 is significantly lower compared to that estimated by DOE for MREFs based on previous market surveys. Due to the uncertainty on the breakdown of MREFs between wine chillers and other miscellaneous refrigeration applications in the U.S. market, DOE continued to use the 13.3 percent penetration rate for MREFs in this NOPR. However, DOE also modeled an alternative shipments scenario based on the lower penetration rate of MREFs in American homes derived from the RECS 2020 data. For more details on this alternative scenario and the resulting NES and NPV results, see chapter 9 and appendix 10C of the NOPR TSD, respectively. As part of its request for comment below, DOE requests input on its shipments modeling.

[35] Greenblatt, J.B., S.J. Young, H.-C. Yang, T. Long, B. Beraki, S.K. Price, S. Pratt, H. Willem, L.-B. Desroches, and S.M. Donovan. U.S. Residential Miscellaneous Refrigeration Products: Results from Amazon Mechanical Turk Surveys. 2014. Lawrence Berkeley National Laboratory: Berkeley, CA. Report No. LBNL–6537E.

[36] Donovan, S.M., S.J. Young, and J.B. Greenblatt. Ice-Making in the U.S.: Results from an Amazon Mechanical Turk Survey. Lawrence Berkeley National Laboratory. Report No. LBNL–183899.

[37] *https://www.npd.com/.*

shipments.[38] Based on this approach, DOE's estimate of the MREF shipments for the whole market was consistent with the total number of shipments estimated using DOE's approach discussed earlier and used in the January 2022 Preliminary Analysis. Hence, DOE continued using the same approach to develop the total MREF shipments, but incorporated the product class breakdown provided by AHAM to re-distribute the total shipments by product class.

DOE is requesting comment on this approach and welcomes comment and data related to the total MREF shipments, MREF shipments by product class, and the non-AHAM-member shipments.

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.[39] (''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 MREFs sold from 2029 through 2058.

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 product 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 product 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 coded in the Python programming language to calculate the energy savings and the national consumer costs and savings from each TSL and presents the results in the form of a spreadsheet. Interested parties can review DOE's analyses by changing various input quantities within the spreadsheet. The NIA spreadsheet model uses typical values (as opposed to probability distributions) as inputs.

Table IV.6 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.6—SUMMARY OF INPUTS AND METHODS FOR THE NATIONAL IMPACT ANALYSIS

Inputs	Method
Shipments	Annual shipments from shipments model.
Compliance Date of Standard	2029.
Efficiency Trends	No trend assumed.
Annual Energy Consumption per Unit	Calculated for each efficiency level based on inputs from energy use analysis.
Total Installed Cost per Unit	Prices for the year of compliance are calculated in the LCC analysis. Prices in subsequent years are calculated incorporating price learning based on historical data.
Annual Energy Cost per Unit	Calculated for each efficiency level using the energy use per unit, and electricity prices and trends.
Repair and Maintenance Cost per Unit	Annual values do not change with efficiency level.
Energy Price Trends	*AEO 2022* projections to 2050 and fixed at 2050 prices thereafter.
Energy Site-to-Primary and FFC Conversion	A time-series conversion factor based on *AEO 2022.*
Discount Rate	3 percent and 7 percent.
Present Year	2022.

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.8 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 product classes for the year of anticipated compliance with an amended standard.

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 (2029). 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.

In the absence of data on trends in efficiency, DOE assumed no efficiency trend over the analysis period for both the no-new-standards and standards cases. For a given case, market shares by efficiency level were held fixed to their 2029 distribution. DOE requests comment on its assumption of no efficiency trend and seeks historical product efficiency data.

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

[38] DOE also collected and reviewed manufacturer interview data but was unable to collect a representative sample that would allow it to estimate non-AHAM-member shipments data.

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

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 *AEO 2022.* Cumulative energy savings are the sum of the NES for each year over the timeframe of the analysis.

Use of higher-efficiency products is occasionally associated with a direct rebound effect, which refers to an increase in utilization of the product due to the increase in efficiency. DOE did not find any data on the rebound effect specific to MREFs that would indicate that consumers would alter their utilization of their product as a result of an increase in efficiency. MREFs are typically plugged in and operate continuously; therefore, DOE assumed a rebound rate of 0.

In 2011, 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 (Aug. 18, 2011). After evaluating the approaches discussed in the August 18, 2011 notice, DOE published a statement of amended policy in which DOE 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 (Aug. 17, 2012). NEMS is a public domain, multi-sector, partial equilibrium model of the U.S. energy sector [40] 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 10B 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 (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 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 MREF price trends based on an experience curve calculated using historical PPI data. DOE applied the same trends to project prices for each product class at each considered efficiency level. By 2058, which is the end date of the projection period, the average price of single-speed compressor MREFs is projected to drop 14 percent and the average price of MREFs with a variable-speed compressor is projected to drop about 15 percent relative to 2029, the compliance year. 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 MREFs. In addition to the default price trend, DOE considered high and low- price- decline sensitivity cases. For the single-speed compressor MREFs and the non-variable- speed controls portion of MREFs, DOE estimated the high price decline and the low- price- decline scenarios based on household refrigerator and home freezer PPI data limited to the period between the period 1989–2008 and 2009–2021, respectively. For the variable-speed controls portion of MREFs, DOE estimated the high price decline and the low- price- decline scenarios based on an exponential trend line fit of the semiconductor PPI between the period 1994–2021 and 1967–1993, respectively. The derivation of these price trends and the results of these sensitivity cases are described in appendix 10C of the NOPR TSD.

The operating cost savings are energy cost savings, which 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 regional energy prices by the projection of annual national-average residential energy price changes in the Reference case from *AEO 2022,* which has an end year of 2050. To estimate price trends after 2050, DOE used the average annual rate of change in prices from 2020 through 2050. As part of the NIA, DOE also analyzed scenarios that used inputs from variants of the *AEO 2022* 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 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.[41] 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 senior-only households. DOE did not consider low-income consumers in this NOPR because MREFs are not products generally used by this subgroup, as they typically cost more than comparable compact refrigerators, which are able to maintain lower temperatures compared to MREFs, and therefore serve a wider range of applications. The analysis used a subset of the TraQline consumer sample composed of households that meet the criteria for this subgroup. DOE used the LCC and PBP spreadsheet model to

[40] For more information on NEMS, refer to *The National Energy Modeling System: An Overview 2018,* DOE/EIA–0581(2018), April 2019. Available at *www.eia.gov/outlooks/aeo/nems/documentation/* (last accessed September 22, 2022).

[41] United States Office of Management and Budget. *Circular A–4: Regulatory Analysis.* September 17, 2003. Section E. Available at *https://obamawhitehouse.archives.gov/omb/circulars_a004_a-4/* (last accessed September 30, 2022).

estimate the impacts of the considered efficiency levels on senior-only households. Chapter 11 in the NOPR TSD describes the consumer subgroup analysis. However, DOE acknowledges the potential limitations of this dataset to capture possible areas of the market, in particular smaller businesses (*e.g.* restaurants and bars), that are users of products such as wine chillers. DOE believes it is likely that a fraction of the purchasers of MREFs are likely small business owners who utilize such cooler products to keep beverages cool within restaurants.

DOE requests comment on the subgroup analysis for MREF products, and specifically whether to any significant extent these products are in use by smaller or comparatively lower-income, small businesses. DOE is also interested in understanding the number of potential small business purchasers of MREFs that would be impacted at DOE's proposed TSL 4 and how such impacts may be different than those of the overall samples.

J. Manufacturer Impact Analysis

1. Overview

DOE performed an MIA to estimate the financial impacts of amended energy conservation standards on manufacturers of MREFs 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 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, Federal 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 MREF manufacturing industry based on the market and technology assessment and publicly available information. This included a top-down analysis of MREF 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 MREF manufacturing industry, including company filings of Form 10-Ks from the SEC,[42] corporate annual reports, the U.S. Census Bureau's *Annual Survey of Manufactures (''ASM''),*[43] and reports from Dun & Bradstreet.[44]

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 MREFs 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 manufacturer subgroups.

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, ''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 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, manufacturer markups, shipments, and industry financial

[42] U.S. Securities and Exchange Commission, *Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system.* Available at *www.sec.gov/edgar/search/* (last accessed July 1, 2022).

[43] U.S. Census Bureau, *Annual Survey of Manufactures.* ''Summary Statistics for Industry Groups and Industries in the U.S (2020).'' Available at: *www.census.gov/data/tables/time-series/econ/asm/2018–2020-asm.html* (Last accessed July 15, 2022).

[44] The Dun & Bradstreet Hoovers login is available at: *app.dnbhoovers.com* (Last accessed July 15, 2022).

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 NOPR publication year) and continuing to 2058. DOE calculated INPVs by summing the stream of annual discounted cash flows during this period. For manufacturers of MREFs, DOE used a real discount rate of 7.7 percent, 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 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 and shipments analysis, and information gathered from industry stakeholders during the course of manufacturer interviews. The GRIM results are presented in section I.B.2. 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 products can affect the revenues, gross margins, and cash flow of the industry. 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 NOPR publication year) to 2058 (the end year of the analysis period). See chapter 9 of the NOPR TSD for additional details or section IV.G of this document.

c. Product and Capital Conversion Costs

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

Product Conversion Costs

DOE based its estimates of the product conversion costs necessary to meet the varying efficiency levels on information from manufacturer interviews, the design paths analyzed in the engineering analysis, the prior MREF rulemaking analysis, and market share and model count information. 81 FR 75194. Generally, manufacturers indicated a preference to meet amended standards with design options that were direct and relatively straight forward component swaps. However, at higher efficiency levels, manufacturers anticipated the need for platform redesigns. Efficiency levels that significantly altered cabinet construction would require very large investments to update designs. Manufacturers noted that increasing foam thickness would require complete redesign of the cabinet, liner, and shelving due to loss of interior volume. Additionally, extensive use of VIPs would require redesign of the cabinet to maximize the benefits of VIPs.

Capital Conversion Costs

DOE relied on information from manufacturer interviews and the engineering analysis to evaluate the level of capital conversion costs would likely incur at the considered standard levels. During interviews, manufacturers provided estimates and descriptions of the required tooling changes that would be necessary to upgrade product lines to meet the various efficiency levels. Based on these inputs, DOE modeled incremental capital conversion costs for efficiency levels that could be reached with individual components swaps. However, based on feedback, DOE modeled higher capital conversion costs when manufacturers would have to redesign their existing product platforms. DOE used information from manufacturer interviews to determine the cost of the manufacturing equipment and tooling necessary to implement complete redesigns.

Increases in foam thickness require either reductions to interior volume or increases to exterior volume. Many MREFs are sized to fit standard widths, meaning any increase in foam thickness would likely result in the loss of interior volume. Additionally, many MREFs are sized to maximize storage of specific products (*e.g.,* canned beverages or wine bottles) and small changes in wall thickness could dramatically decrease the unit storage capacity for those products. The reduction of interior volume has significant consequences for manufacturing. Redesigning the cabinet to increase the effectiveness of insulation likely requires manufacturers to update designs and tooling associated with the interior of the product. This could require investing in new tooling to accommodate changes to the liner, shelving, drawers, and doors.

To minimize reductions to interior volume, manufacturers may choose to adopt VIP technology. Extensive incorporation of VIPs into designs require significant upfront capital due to differences in the handling, storing, and manufacturing of VIPs as compared to typical polyurethane foams. VIPs are relatively fragile and must be protected from punctures and rough handling. If VIPs have leaks of any size, the panel will eventually lose much of its thermal insulative properties and structural strength. If already installed within a cabinet wall, a punctured VIP may significantly reduce the structural strength of the MREF cabinet. As a result, VIPs require careful handling and installation. Manufacturers noted the need to allocate special warehouse space in order to ensure the VIPs are not jostled or roughly handled in the manufacturing environment. VIPs require significantly more warehouse space than polyurethane foams. The application of VIPs can be difficult and may require investment in hard-tooling or robotic systems to ensure the panels are positioned properly within the cabinet or door. Manufacturers noted that producing cabinets with VIPs are much more labor and time intensive than producing cabinets with typical polyurethane foams and the increase in labor can affect total production capacity.

To develop industry conversion cost estimates, DOE estimated the number of product platforms in DOE's CCD[45] and California Energy Commission's Modernized Appliance Efficiency Database System (''MAEDbS'')[46] and scaled up the product and capital conversion costs associated with the number of product platforms that would require updating at each efficiency level.

DOE acknowledges that manufacturers may follow different design paths to reach the various efficiency levels analyzed. An individual manufacturer's investments depend on a range of factors, including the company's current product offerings and product platforms, existing production facilities and infrastructure, and make vs. buy decisions for products. DOE's conversion cost methodology incorporated feedback from all manufacturers that took part in interviews and extrapolated industry values. While industry average values may not represent any single manufacturer, DOE's modeling provides reasonable estimates of industry-level investments.

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 product class and efficiency level. Modifying these 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 a single uniform ''gross margin percentage'' 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 a product class. As manufacturer production costs increase with efficiency, this scenario implies that the per-unit dollar profit will increase. DOE assumed a gross margin percentage of 20 percent for freestanding compact coolers and 28 percent for all other product classes.[47] Manufacturers tend to believe it is optimistic to assume that they would be able to maintain the same gross margin percentage as their production costs increase, particularly for minimally efficient products. Therefore, this scenario represents a high bound of industry profitability under an amended energy conservation standard.

In the preservation of operating profit scenario, as 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 lowering 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.

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

3. Manufacturer Interviews

DOE interviewed manufacturers including domestic-based and foreign-based original equipment manufacturers (''OEMs'') as well as importers. Participants included manufacturers offering a range of product classes, including both freestanding and built-in designs.

In interviews, DOE asked manufacturers to describe their major concerns regarding potential increases in energy conservation standards for MREFs. 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 non-disclosure 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. Supply Chain Constraints

In interviews, some manufacturers expressed concerns about the ongoing supply chain constraints related to sourcing high-quality components (*e.g.,* VSCs, VIPs) as well as microprocessors and electronics. More stringent standards, particularly at TSLs requiring a large-scale implementation of VSCs, would require that industry source more high-efficiency compressors and electronic components, which are already difficult to secure. If these supply constraints continue through the end of the conversion period, industry could face production capacity constraints.

b. Built-In Product Classes

Some manufacturers urged DOE to conduct a separate analysis for built-in product classes. These manufacturers noted that built-in MREFs face design constraints related to standardized installation dimensions (*i.e.,* maintaining the same width and not exceeding countertop depth). These manufacturers asserted that because of the desire to maintain the same external dimensions, increased insulation thickness would likely come at the expense of internal volume. For MREFs designed to store wine, manufacturers explained that even small changes to internal volume would have a significant impact in terms of ''bottle count,'' which is a key consumer feature and often referenced in marketing material (*e.g.,* a 32-bottle wine cooler). Since these products are likely already optimized to hold the maximum number of standard-size wine bottles, even a small reduction in the interior width could mean losing an entire column of bottle space. Some manufacturers also noted built-ins have

[45] 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 September 22, 2022).

[46] California Energy Commission's Modernized Appliance Efficiency Database System is available at: *cacertappliances.energy.ca.gov/Pages/ApplianceSearch.aspx* (Last accessed September 22, 2022). DOE used this database to gather product information not provided in DOE's CCD (*e.g.,* manufacturer names).

[47] The gross margin percentages of 20 percent and 28 percent are based on manufacturer markups of 1.25 and 1.38 percent, respectively.

restricted airflow. These manufacturers stated that because of these differences, freestanding products cannot be used as proxies for built-in products.

4. Discussion of MIA Comments

In response to the January 2022 Preliminary Analysis, AHAM asserted that achieving additional energy savings beyond EL 1—particularly for built-in product classes—would require significant redesign of product platforms and retooling. Specifically for built-in products, AHAM asserted that given the low shipment volumes, the significant investment required to meet more stringent efficiencies would lead to significant degradation in INPV. (AHAM, No. 18, pp. 6, 9). AHAM also asserted that any efficiency levels that necessitate changes in chassis size would result in costly changes to tooling. (AHAM, No. 18, p. 6).

As discussed in section IV.J.2.c, DOE relied on multiple sources, including manufacturer feedback from interviews, to estimate conversion costs for each of the analyzed efficiency levels. See Table V.20 for DOE's capital and product conversion cost estimates. See chapter 12 of the NOPR TSD for INPV results by product grouping.

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 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 *AEO 2022.* Power sector emissions of CH_4 and N_2O from fuel combustion are estimated using Emission Factors for Greenhouse Gas Inventories published by the Environmental Protection Agency (EPA).[48]

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. *AEO 2022* generally represents current legislation and environmental regulations, including recent government actions, that were in place at the time of preparation of *AEO 2022,* including the emissions control programs discussed in the following paragraphs.[49]

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.[50] *AEO 2022* 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. 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. *I*n 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. 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 *AEO 2022.*

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

[48] Available at *https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator* (last accessed September 22, 2022).

[49] For further information, see the Assumptions to *AEO 2022* 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 September 22, 2022).

[50] 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).

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 *AEO 2022* data to derive NO_X emissions factors for the group of States not covered by CSAPR.

The MATS limit mercury emissions from power plants, but they do not include emissions caps and, as such, DOE's energy conservation standards would be expected to slightly reduce Hg emissions. DOE estimated mercury emissions reduction using emissions factors based on *AEO 2022,* 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 the emissions benefits and presents the values considered in this NOPR.

On March 16, 2022, the Fifth Circuit Court of Appeals (No. 22–30087) granted the Federal government's emergency motion for stay pending appeal of the February 11, 2022, preliminary injunction issued in *Louisiana* v. *Biden,* No. 21–cv–1074–JDC–KK (W.D. La.). As a result of the Fifth Circuit's order, the preliminary injunction is no longer in effect, pending resolution of the Federal government's appeal of that injunction or a further court order. Among other things, the preliminary injunction enjoined the defendants in that case from ''adopting, employing, treating as binding, or relying upon'' the interim estimates of the social cost of greenhouse gases—which were issued by the Interagency Working Group on the Social Cost of Greenhouse Gases on February 26, 2021—to monetize the benefits of reducing greenhouse gas emissions. As reflected in this rule, DOE has reverted to its approach prior to the injunction and presents monetized GHG abatement benefits where appropriate and permissible under law. DOE requests comment on how to address the climate benefits and other non-monetized effects of the proposal.

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, including the February 2021 Interim Estimates presented by the Interagency Working Group on the Social Cost of Greenhouse Gases. DOE estimated the global social benefits of CO_2, CH_4, and N_2O reductions (*i.e.,* SC–GHGs) using the estimates presented in the TSD: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990, published in February 2021 by the IWG. 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.*[51] 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

[51] 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.

updates to ensure that the estimates continue to reflect the best available science and methodologies. In January 2017, the National Academies released their final report, Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide, and recommended specific criteria for future updates to the SC–CO_2 estimates, a modeling framework to satisfy the specified criteria, and both near-term updates and longer-term research needs pertaining to various components of the estimation process (National Academies, 2017).[52] 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 of the National Academies (2017). 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 to undertake a fuller update of the SC–GHG estimates by January 2022 that takes into consideration the advice of the National Academies (2017) 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 (2017) and the economic literature, the IWG continued to conclude that the consumption rate of interest is the theoretically appropriate discount rate in an intergenerational context,[53] 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

[52] 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.

[53] 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 September 22, 2022.) *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 September 22, 2022.) *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 September 22, 2022.) *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 September 22, 2022.) *www.epa.gov/sites/default/files/2016-12/documents/addendum_to_sc-ghg_tsd_august_2016.pdf.*

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. 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 this 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 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 to revert to the same set of four values drawn from the SC–GHG distributions based on three discount rates as were used in regulatory analyses between 2010 and 2016 and subject to public comment. 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.[54] 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 final rule likely underestimate the damages from GHG emissions. DOE concurs with this assessment.

DOE's derivations of the SC–GHG (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 I.B.6 of this document.

a. Social Cost of Carbon

The SC–CO_2 values used for this NOPR were generated using the values presented in the 2021 update from the IWG's February 2021 SC–GHG TSD. Table IV.7 shows the updated sets of SC–CO_2 estimates from the latest interagency update in 5-year increments from 2020 to 2050. The full set of annual values used is presented in Appendix 14–A of the NOPR TSD. For purposes of capturing the uncertainties involved in regulatory impact analysis, DOE has determined it is appropriate include all four sets of SC–CO_2 values, as recommended by the IWG.[55]

[54] 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: *https://www.whitehouse.gov/briefing-room/blog/2021/02/26/a-return-to-science-evidence-based-estimates-of-the-benefits-of-reducing-climate-pollution/*. (Last accessed September 22, 2022).

[55] For example, the February 2021 TSD discusses how the understanding of discounting approaches suggests that discount rates appropriate for intergenerational analysis in the context of climate change may be lower than 3 percent.

TABLE IV.7—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

For 2051 to 2070, DOE used estimates published by EPA, adjusted to 2020$.[56] These estimates are based on methods, assumptions, and parameters identical to the 2020–2050 estimates published by the IWG. DOE expects additional climate benefits to accrue for any longer-life MREFs 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. If further analysis of monetized climate benefits beyond 2070 becomes available prior to the publication of the final rule, DOE will include that analysis in the final rule.

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 2021$ 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 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 generated using the values presented in the February 2021 SC–GHG TSD. Table IV.8 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.8—ANNUAL SC–CH_4 AND SC–N_2O VALUES FROM 2021 INTERAGENCY UPDATE, 2020–2050

[2020$ per metric ton]

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

DOE multiplied the CH_4 and N_2O emissions reduction estimated for each year by the SC–CH_4 and SC–N_2O estimates for that year in each of the cases. DOE adjusted the values to 2021$ 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 this NOPR analysis, 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.[57] 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 derived values specific to the sector for MREFs using a method described in appendix 14B of the NOPR TSD.

[56] See EPA, *Revised 2023 and Later Model Year Light-Duty Vehicle GHG Emissions Standards: Regulatory Impact Analysis,* Washington, DC, December 2021. Available at: *https://www.federalregister.gov/documents/2021/12/30/2021-27854/revised-2023-and-later-model-year-light-duty-vehicle-greenhouse-gas-emissions-standards* (last accessed September 22, 2022).

[57] *Estimating the Benefit per Ton of Reducing $PM_{2.5}$ Precursors from 21 Sectors.* (Last accessed September 22, 2022) *www.epa.gov/benmap/estimating-benefit-ton-reducing-pm25-precursors-21-sectors.*

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 *AEO 2022.* 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 *AEO 2022* 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 products subject to standards. The MIA addresses those impacts. Indirect employment impacts are changes in national employment that occur due to 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 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.[58] 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'').[59] 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 (2029–2033), 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 MREFs. It addresses the TSLs examined by DOE, the projected impacts of each of these levels if adopted as energy conservation standards for MREFs, 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 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 product classes, to the extent that there are such interactions, and market cross elasticity from 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 five TSLs for MREFs. DOE developed TSLs that combine efficiency levels for each analyzed product class. These TSLs were developed by combining specific efficiency levels for each of the MREF product classes analyzed by DOE. TSL 1 represents a 10 percent increase in efficiency, corresponding to the lowest analyzed efficiency level above the baseline for each analyzed product class. TSL 2 represents efficiency levels consistent with Energy Star requirements for coolers and a modest increase in efficiency for certain combination cooler product classes. TSL 3 increases the efficiency for freestanding (FC) and built-in (BIC) coolers by an additional 10% compared to TSL 1, while maintaining the same efficiency levels as TSL 2 for combination coolers. TSL 4 further increases the efficiency levels for the product classes that make up the vast majority of MREF shipments (FCC, FC, C–13A). TSL 5 represents max-tech for each product class. DOE presents the

[58] 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 *apps.bea.gov/scb/pdf/regional/perinc/meth/rims2.pdf* (last accessed September 30, 2022).

[59] 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.

results for the TSLs in this document, while the results for all efficiency levels that DOE analyzed are in the NOPR TSD.

Table V.1 presents the TSLs and the corresponding efficiency levels that DOE has identified for potential amended energy conservation standards for MREFs.

TABLE V.1—TRIAL STANDARD LEVELS FOR MREFS

	FCC	FC	BICC	BIC	C–13A	C–13A–BI	C–3A	C–3A–BI
TSL 1	EL 1	EL 1	EL 1	EL 1	EL 1	EL 1	EL 1	EL 1
TSL 2	EL 2	EL 1	EL 3	EL 3	EL 2	EL 2	EL 1	EL 1
TSL 3	EL 2	EL 2	EL 3	EL 2	EL 2	EL 2	EL 1	EL 1
TSL 4	EL 3	EL 3	EL 3	EL 2	EL 3	EL 3	EL 1	EL 1
TSL 5	EL 5	EL 5	EL 5	EL 5	EL 5	EL 5	EL 4	EL 4

B. Economic Justification and Energy Savings

1. Economic Impacts on Individual Consumers

DOE analyzed the economic impacts on MREF 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 and operating costs (*i.e.,* annual energy use, energy prices, energy price trends, and repair 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.2 through Table V.17 show the LCC and PBP results for the TSLs considered for each product 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 IV.F.8 of this document). Because some consumers purchase products 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.

TABLE V.2—AVERAGE LCC AND PBP RESULTS FOR FCC

TSL	Efficiency level	Average costs (2021$)				Simple payback years	Average lifetime years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	Baseline	533.1	27.6	242.8	775.9		10.6
1	1	538.3	25.0	220.2	758.5	2.0	10.6
2,3	2	559.6	22.3	195.9	755.5	5.0	10.6
4	3	586.0	19.7	173.6	759.6	6.8	10.6
	4	627.6	17.1	150.0	777.5	9.0	10.6
5	5	713.1	11.9	104.3	817.4	11.5	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.3—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR FCC

TSL	Efficiency level	Life-cycle cost savings	
		Average LCC savings* (2021$)	Percent of consumers that experience net cost
1	1	17.4	2.8
2,3	2	17.2	33.5
4	3	12.6	49.5
	4	−5.4	65.7
5	5	−45.3	77.8

*The savings represent the average LCC for affected consumers.

TABLE V.4—AVERAGE LCC AND PBP RESULTS FOR FC

TSL	Efficiency level	Average costs (2021$)				Simple payback years	Average lifetime years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	Baseline	1,391.3	41.5	473.2	1,864.5		14.6
1,2	1	1,415.2	37.4	425.8	1,841.0	5.8	14.6
3	2	1,421.3	33.6	382.3	1,803.6	3.8	14.6
4	3	1,487.3	29.5	335.5	1,822.8	8.0	14.6
	4	1,705.2	27.6	313.6	2,018.8	22.5	14.6
5	5	1,727.0	26.6	302.6	2,029.6	22.5	14.6

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.5—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR FC

TSL	Efficiency level	Life-cycle cost savings	
		Average LCC savings* (2021$)	Percent of consumers that experience net cost
1,2	1	23.5	8.8
3	2	47.2	1.6
4	3	28.0	45.5
	4	−168.0	94.7
5	5	−178.8	94.5

*The savings represent the average LCC for affected consumers.

TABLE V.6—AVERAGE LCC AND PBP RESULTS FOR BICC

TSL	Efficiency level	Average costs (2021$)				Simple payback years	Average lifetime years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	Baseline	735.1	27.6	244.8	979.8		10.7
1	1	741.3	25.0	221.3	962.5	2.4	10.7
	2	766.3	22.3	197.8	964.1	5.9	10.7
2–4	3	797.7	19.7	174.3	972.0	7.9	10.7
	4	847.2	17.1	150.8	998.0	10.6	10.7
5	5	949.6	12.0	106.1	1,055.7	13.8	10.7

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.7—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR BICC

TSL	Efficiency level	Life-cycle cost savings	
		Average LCC savings* (2021$)	Percent of consumers that experience net cost
1	1	17.2	1.0
	2	11.3	11.1
2–4	3	2.9	15.3
	4	−23.2	20.1
5	5	−80.9	22.7

*The savings represent the average LCC for affected consumers.

TABLE V.8—AVERAGE LCC AND PBP RESULTS FOR BIC

TSL	Efficiency level	Average costs (2021$)				Simple payback years	Average lifetime years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	Baseline	1,871.9	41.6	474.4	2,346.3		14.6
1	1	1,897.3	37.6	428.9	2,326.2	6.4	14.6

TABLE V.8—AVERAGE LCC AND PBP RESULTS FOR BIC—Continued

TSL	Efficiency level	Average costs (2021$)				Simple payback years	Average lifetime years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
3,4	2	1,903.8	33.6	383.4	2,287.2	4.0	14.6
2	3	1,974.0	29.7	337.9	2,311.9	8.6	14.6
	4	2,205.9	27.7	315.2	2,521.1	24.0	14.6
5	5	2,229.1	26.5	301.5	2,530.6	23.6	14.6

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.9 AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR BIC

TSL	Efficiency Level	Life-cycle cost savings	
		Average LCC savings* (2021$)	Percent of consumers that experience net cost
1	1	20.3	18.7
3,4	2	57.3	3.6
2	3	21.2	53.4
	4	−187.9	94.6
5	5	−197.4	94.3

*The savings represent the average LCC for affected consumers.

TABLE V.10—AVERAGE LCC AND PBP RESULTS FOR C–13A

TSL	Efficiency level	Average costs (2021$)				Simple payback years	Average lifetime years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	Baseline	1,148.0	33.8	295.5	1,443.5		10.6
1	1	1,151.6	30.6	267.2	1,418.7	1.1	10.6
2,3	2	1,154.7	28.9	253.0	1,407.7	1.4	10.6
4	3	1,192.3	27.3	238.9	1,431.2	6.9	10.6
	4	1,234.6	25.7	224.9	1,459.5	10.7	10.6
5	5	1,301.3	24.6	215.3	1,516.6	16.7	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.11—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR C–13A

TSL	Efficiency level	Life-cycle cost savings	
		Average LCC savings* (2021$)	Percent of consumers that experience net cost
1	1	24.8	0.3
2,3	2	35.5	1.0
4	3	12.0	47.5
	4	−16.3	74.3
5	5	−73.4	90.3

*The savings represent the average LCC for affected consumers.

TABLE V.12—AVERAGE LCC AND PBP RESULTS FOR C–13A–BI

TSL	Efficiency level	Average costs (2021$)				Simple payback years	Average lifetime years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	Baseline	1,371.7	37.1	327.9	1,699.6		10.6
1	1	1,375.4	33.6	296.5	1,672.0	1.1	10.6
2,3	2	1,378.7	31.8	280.8	1,659.6	1.3	10.6
4	3	1,418.8	30.0	265.2	1,684.0	6.7	10.6
	4	1,463.8	28.2	249.5	1,713.3	10.4	10.6

TABLE V.12—AVERAGE LCC AND PBP RESULTS FOR C–13A–BI—Continued

TSL	Efficiency level	Average costs (2021$)				Simple payback years	Average lifetime years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
5	5	1,534.8	27.1	239.0	1,773.9	16.3	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.13—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR C–13A–BI

TSL	Efficiency level	Life-cycle cost savings	
		Average LCC Savings * (2021$)	Percent of consumers that experience net cost
1	1	27.6	0.3
2,3	2	39.6	0.7
4	3	15.3	44.4
	4	−14.1	72.0
5	5	−74.6	89.7

* The savings represent the average LCC for affected consumers.

TABLE V.14—AVERAGE LCC AND PBP RESULTS FOR C–3A

TSL	Efficiency level	Average costs (2021$)				Simple payback years	Average lifetime years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	Baseline	1,289.8	34.0	388.9	1,678.7		14.6
1–4	1	1,295.4	30.8	351.7	1,647.1	1.7	14.6
	2	1,344.7	29.3	334.3	1,678.9	11.5	14.6
	3	1,510.5	27.7	316.6	1,827.0	35.0	14.6
5	4	1,611.2	26.4	300.9	1,912.1	41.9	14.6

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.15—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR C–3A

TSL	Efficiency level	Life-cycle cost savings	
		Average LCC savings * (2021$)	Percent of consumers that experience net cost
1–4	1	31.5	0.0
	2	−0.3	63.9
	3	−148.4	98.3
5	4	−233.4	99.4

* The savings represent the average LCC for affected consumers.

TABLE V.16—AVERAGE LCC AND PBP RESULTS FOR C–3A–BI

TSL	Efficiency level	Average costs (2021$)				Simple payback years	Average lifetime years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	Baseline	1,760.9	38.9	444.5	2,205.4		14.6
1–4	1	1,766.9	35.2	401.8	2,168.7	1.6	14.6
	2	1,819.3	33.3	380.5	2,199.8	10.5	14.6
	3	1,995.8	31.4	359.2	2,355.0	31.6	14.6
5	4	2,103.0	30.0	343.1	2,446.1	38.7	14.6

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.17—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR C–3A–BI

TSL	Efficiency level	Life-cycle cost savings	
		Average LCC savings* (2021$)	Percent of consumers that experience net cost
1–4	1	36.7	0.0
	2	5.5	57.8
	3	−149.6	97.5
5	4	−240.7	98.9

*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 senior-only households. DOE did not consider low-income consumers in this NOPR because MREFs are not products generally used by this subgroup, as they typically cost more than comparable compact refrigerators, which are able to maintain lower temperatures compared to MREFs, and therefore serve a wider range of applications. Table V.18 compares the average LCC savings and PBP at each TSL for the senior-only consumer subgroup with similar metrics for the entire consumer sample for all product classes. In most cases, the average LCC savings and PBP for senior-only households at the considered efficiency levels are improved (*i.e.,* higher LCC savings and equal or lesser payback periods) from the average for all households. Chapter 11 of the NOPR TSD presents the complete LCC and PBP results for the subgroup.

TABLE V.18—COMPARISON OF LCC SAVINGS AND PBP FOR SENIOR-ONLY CONSUMER SUBGROUP AND ALL CONSUMERS

TSL	Average LCC savings* *(2021$)*		Simple payback *years*	
	Senior-only households	All households	Senior-only households	All households
FCC				
1	18.4	17.4	2.0	2.0
2,3	19.0	17.2	4.8	5.0
4	15.1	12.6	6.5	6.8
5	−40.5	−45.3	11.1	11.5
FC				
1,2	26.1	23.5	5.6	5.8
3	51.2	47.2	3.6	3.8
4	33.4	28.0	7.7	8.0
5	−178.1	−178.8	21.7	22.5
BICC				
1	18.4	17.2	2.5	2.4
2–4	1.6	2.9	8.3	7.9
5	−94.3	−80.9	14.4	13.8
BIC				
1	20.4	20.3	6.7	6.4
3,4	59.8	57.3	4.2	4.0
2	18.8	21.2	8.9	8.6
5	−224.5	−197.4	24.6	23.6
C–13A				
1	26.4	24.8	1.1	1.1
2,3	37.9	35.5	1.3	1.4
4	14.2	12.0	6.7	6.9
5	−72.9	−73.4	16.3	16.7
C–13A–BI				
1	29.1	27.6	1.1	1.1
2,3	41.7	39.6	1.4	1.3
4	14.0	15.3	7.0	6.7
5	−86.7	−74.6	17.0	16.3
C–3A				
1–4	33.5	31.5	1.7	1.7
5	−237.1	−233.4	40.6	41.9
C–3A–BI				
1–4	39.5	36.7	1.7	1.6
5	−268.9	−240.7	40.1	38.7

*The savings represent the average LCC for affected consumers.

c. Rebuttable Presumption Payback

As discussed in section IV.F.9, 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's 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 MREFs, with adjustment for icemaker adder, as discussed in more detail in section III.B of this document. In contrast, the PBPs presented in section I.B.a were calculated using distributions that reflect the range of energy use in the field.

Table V.19 presents the rebuttable presumption payback periods for the considered TSLs for MREFs. While DOE examined the rebuttable presumption criterion, it considered whether the proposed 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.19—REBUTTABLE PRESUMPTION PAYBACK PERIODS

Efficiency level	Rebuttable payback period (years)							
	FCC	FC	BICC	BIC	C–13A	C–13A–BI	C–3A	C–3A–BI
1	2.0	5.5	2.3	6.2	1.1	1.0	1.7	1.6
2	4.8	3.6	5.7	3.9	1.3	1.3	11.1	10.2
3	6.6	7.6	7.7	8.3	6.7	6.4	33.8	30.7
4	8.7	21.6	10.3	23.2	10.4	10.1	40.4	37.6
5	11.2	21.6	13.3	22.8	16.3	15.7		

2. Economic Impacts on Manufacturers

DOE performed an MIA to estimate the impact of amended energy conservation standards on manufacturers of MREFs. 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 MREFs, as well as the conversion costs that DOE estimates manufacturers of MREFs 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 20 percent for freestanding compact coolers and 28 percent for all other product classes, across all efficiency levels.[60] This scenario assumes that a manufacturer's per-unit dollar profit would increase as MPCs increase in the standards cases and represents the upper bound to industry profitability under potential new and 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 products, operating profit does not change in absolute dollars and decreases as a percentage of revenue. The preservation of operating profit scenario 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 NOPR publication year through the end of the analysis period (2023–2058). 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.20—MANUFACTURER IMPACT ANALYSIS RESULTS FOR MISCELLANEOUS REFRIGERATION PRODUCTS

	Unit	No-New-Standards Case	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
INPV	*2021$ Million*	742.0	711.3 to 714.7	695.4 to 706.2	697.3 to 706.6	652.3 to 679.4	356.7 to 458.8
Change in INPV	%		(4.1) to (3.7)	(6.3) to (4.8)	(6.0) to (4.8)	(12.1) to (8.4)	(51.9) to (38.2)
Free Cash Flow (2028).	*2021$ Million*	55.3	37.1	30.1	31.5	9.5	(169.3)
Change in Free Cash Flow (2028).	%		(33.0)	(45.7)	(43.1)	(82.8)	(406.0)

[60] The gross margin percentages of 20 percent and 28 percent are based on manufacturer markups of 1.25 and 1.38 percent, respectively.

TABLE V.20—MANUFACTURER IMPACT ANALYSIS RESULTS FOR MISCELLANEOUS REFRIGERATION PRODUCTS—Continued

	Unit	No-New-Standards Case	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Product Conversion Costs.	*2021$ Million*	....	52.4	66.4	68.8	101.1	364.5
Capital Conversion Costs.	*2021$ Million*	....	1.2	6.2	1.2	25.8	174.5
Total Conversion Costs.	*2021$ Million*	....	53.6	72.6	67.6	126.9	539.0

*Parentheses denote negative (-) values.

The following cash flow discussion refers to product classes as defined in Table I.1 in section I of this document and the efficiency levels and design options as detailed in Table IV.1 in section IV.C of this document.

At TSL 1, the standard represents the lowest analyzed efficiency level above baseline for all product classes (EL 1). The change in INPV is expected to range from −4.1 to −3.7 percent. At this level, free cash flow is estimated to decrease by 33.0 percent compared to the no-new-standards case value of $55.3 million in the year 2028, the year before the standards year. Currently, approximately 24 percent of domestic MREF shipments meet the efficiencies required at TSL 1.

At TSL 1, DOE analyzed implementing various design options for the range of directly analyzed product classes. These design options could include implementing more efficient single-speed compressors, tube and fin evaporators and/or condensers, among other technologies. At this level, capital conversion costs are minimal since most manufacturers can achieve TSL 1 efficiencies with relatively simple component changes. Product conversion costs may be necessary for developing, qualifying, sourcing, and testing more efficient components. DOE estimates capital conversion costs of $1.2 million and product conversion costs of $52.4 million. Conversion costs total $53.6 million.

At TSL 1, the shipment-weighted average MPC for all MREFs is expected to increase by 0.8 percent relative to the no-new-standards case shipment-weighted average MPC for all MREFs in 2029. Given the relatively small increase in production costs, DOE does not project a notable drop in shipments in the year the standard takes effect. In the preservation of gross margin percentage scenario, the minor increase in cashflow from the higher MSP is slightly outweighed by the $53.6 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 2030, the year after the analyzed compliance year. This reduction in the manufacturer markup and the $53.6 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 efficiency levels consistent with Energy Star requirements for coolers and a modest increase in efficiency for certain combination cooler product classes. The change in INPV is expected to range from −6.3 to −4.8 percent. At this level, free cash flow is estimated to decrease by 45.7 percent compared to the no-new-standards case value of $55.3 million in the year 2028, the year before the standards year. Currently, approximately 11.5 percent of domestic MREF shipments meet the efficiencies required at TSL 2.

The design options DOE analyzed for most product classes include implementing similar design options as TSL 1, such as more efficient single-speed compressors. For built-in coolers, the analyzed design options also include implementing variable-speed compressors and increased insulation thickness. For freestanding compact coolers, C–13A and C–13A-bi, TSL 2 corresponds to EL 2. For built-in compact coolers and built-in coolers, TSL 2 corresponds to EL 3. For the remaining product classes, the efficiencies required at TSL 2 are the same as TSL 1. The increase in conversion costs compared to TSL 1 are largely driven by the higher efficiencies required for built-in coolers, which account for 3 percent of MREF shipments. For products that do not meet this level, increasing insulation thickness would likely mean new cabinets, liners, and fixtures as well as new shelf designs. Implementing variable-speed compressors could require more advanced controls and electronics and new test stations. DOE estimates capital conversion costs of $6.2 million and product conversion costs of $66.4 million. Conversion costs total $72.6 million.

At TSL 2, the shipment-weighted average MPC for all MREFs is expected to increase by 4.2 percent relative to the no-new-standards case shipment-weighted average MPC for all MREFs in 2029. Given the projected increase in production costs, DOE expects an estimated 4 percent drop in shipments in the year the standard takes effect relative to the no-new-standards case. In the preservation of gross margin percentage scenario, the slight increase in cashflow from the higher MSP is outweighed by the $72.6 million in conversion costs, causing a slightly negative change in INPV at TSL 2 under this scenario. Under the preservation of operating profit scenario, the manufacturer markup decreases in 2030, the year after the analyzed compliance year. This reduction in the manufacturer markup and the $72.6 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 an increase in efficiency for freestanding and built-in coolers by additional 10 percent as compared to TSL 1, while maintaining the same efficiency levels as TSL 2 for combination coolers. The change in INPV is expected to range from −6.0 to −4.8 percent. At this level, free cash flow is estimated to decrease by 43.1 percent compared to the no-new-standards case value of $55.3 million in the year 2028, the year before the standards year. Currently, approximately 5.3 percent of domestic MREF shipments meet the efficiencies required at TSL 3.

At this level, DOE analyzed similar design options as TSL 1 and TSL 2, such as implementing incrementally more efficient single-speed compressors. For all product classes except freestanding coolers and built-in coolers, the efficiencies required at TSL 3 are the same as TSL 2. For freestanding coolers, TSL 3 corresponds to EL 2. For built-in coolers, TSL 3 reflects a lower efficiency level (EL 2) as compared to TSL 2 (EL 3). Industry capital conversion costs decrease at TSL 3 as compared to TSL 2 due to the lower efficiency level required for built-in coolers. As previously discussed, DOE expects manufacturers of built-in coolers would likely need to increase insulation thickness at TSL 2 (EL 3) and incorporate variable-speed compressors. However, at TSL 3, DOE's engineering analysis and manufacturer feedback indicate that manufacturers could achieve EL 2 efficiencies for built-in coolers with relatively straightforward component swaps versus a larger product redesign associated with increasing insulation. DOE estimates capital conversion costs of $1.2 million and product conversion costs of $68.8 million. Conversion costs total $70.0 million.

At TSL 3, the shipment-weighted average MPC for all MREFs is expected to increase by 3.9 percent relative to the no-new-standards case shipment-weighted average MPC for all MREFs in 2029. Given the projected increase in production costs, DOE expects an estimated 4 percent drop in shipments in the year the standard takes effect relative to the no-new-standards case. In the preservation of gross margin percentage scenario, the slight increase in cashflow from the higher MSP is outweighed by the $70.0 million in conversion costs, causing a slightly negative change in INPV at TSL 3 under this scenario. Under the preservation of operating profit scenario, the manufacturer markup decreases in 2030, the year after the analyzed compliance year. This reduction in the manufacturer markup and the $70.0 million in conversion costs incurred by manufacturers cause a slightly negative change in INPV at TSL 3 under the preservation of operating profit scenario.

At TSL 4, the standard reflects an increase in efficiency level for the product classes that make up the vast majority of MREF shipments (FCC, FC, C–13A). The change in INPV is expected to range from −12.1 to −8.4 percent. At this level, free cash flow is estimated to decrease by 82.8 percent compared to the no-new-standards case value of $55.3 million in the year 2028, the year before the standards year. Currently, approximately 3.4 percent of domestic MREF shipments meet the efficiencies required at TSL 4.

For all product classes except built-in coolers, C–3A and C–3A–BI, TSL 4 corresponds to EL 3. For built-in coolers, TSL 4 corresponds to EL 2. For C–3A–BI, TSL 4 corresponds to EL 1. For C–3A, the efficiencies required at TSL 4 are the same as TSL 3 (EL 1). At this level, conversion costs are largely driven by the efficiencies required for freestanding coolers, which accounts for approximately 12 percent of industry shipments. DOE's shipments analysis estimates that no freestanding cooler shipments currently meet the efficiencies required at TSL 4. All manufacturers would need to update their product platforms, which could include increasing insulation thickness and implementing variable-speed compressors. Increasing insulation thickness would likely result in the loss of interior volume and would require redesign of the cabinet as well as the designs and tooling associated with the interior of the product, such as the liner, shelving, racks, and drawers. DOE estimates capital conversion costs of $25.8 million and product conversion costs of $101.1 million. Conversion costs total $126.9 million.

At TSL 4, the shipment-weighted average MPC for all MREFs is expected to increase by 10.0 percent relative to the no-new-standards case shipment-weighted average MPC for all MREFs in 2029. Given the projected increase in production costs, DOE expects an estimated 10 percent drop in shipments in the year the standard takes effect relative to the no-new-standards case. In the preservation of gross margin percentage scenario, the increase in cashflow from the higher MSP is outweighed by the $126.9 million in conversion costs and the drop in annual shipments, causing a negative change in INPV at TSL 4 under this scenario. Under the preservation of operating profit scenario, the manufacturer markup decreases in 2030, the year after the analyzed compliance year. This reduction in the manufacturer markup, the $126.9 million in conversion costs incurred by manufacturers, and the drop in annual shipments cause a negative change in INPV at TSL 4 under the preservation of operating profit scenario.

At TSL 5, the standard represents the max-tech efficiency levels for all product classes. The change in INPV is expected to range from −51.9 to −38.2 percent. At this level, free cash flow is estimated to decrease by 406.0 percent compared to the no-new-standards case value of $55.3 million in the year 2028, the year before the standards year. Currently, approximately 2.7 percent of domestic MREF shipments meet the efficiencies required at TSL 5.

DOE's shipments analysis estimates that no shipments meet the efficiencies required across all product classes except for built-in compact coolers, which account for only 4 percent of industry shipments. A max-tech standard would necessitate significant investment to redesign nearly all product platforms and incorporate design options such as the most efficient variable-speed compressors, triple-pane glass, increased foam insulation thickness, and VIP technology. Capital conversion costs may be necessary for new tooling for VIP placement as well as new testing stations for high-efficiency components. Increasing insulation thickness would likely result in the loss of interior volume and would require redesign of the cabinet as well as the designs and tooling associated with the interior of the product, such as the liner, shelving, racks, and drawers. Product conversion costs at max-tech are significant as manufacturers work to completely redesign their product platforms. For products implementing VIPs, product conversion costs may be necessary for prototyping and testing for VIP placement, design, and sizing. Manufacturers implementing triple-pane glass may need to redesign the door frame and hinges to support the added thickness and weight. DOE estimates capital conversion costs of $174.5 million and product conversion costs of $364.5 million. Conversion costs total $539.0 million.

At TSL 5, 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 5, the shipment-weighted average MPC for all MREFs is expected to increase by 32.7 percent relative to the no-new-standards case shipment-weighted average MPC for all MREFs in 2029. Given the projected increase in production costs, DOE expects an estimated 20 percent drop in shipments in the year the standard takes effect relative to the no-new-standards case. In the preservation of gross margin percentage scenario, the increase in cashflow from the higher MSP is outweighed by the $539.0 million in conversion costs and drop in annual shipments, causing a significant negative change in INPV at TSL 5 under this scenario. Under the preservation of operating profit scenario, the manufacturer markup decreases in 2030, the year after the analyzed compliance year. This reduction in the manufacturer markup, the $539.0 million in conversion costs incurred by manufacturers, and the drop in annual shipments cause a significant decrease in INPV at TSL 5 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.

b. Direct Impacts on Employment

To quantitatively assess the potential impacts of amended energy conservation standards on direct employment in the MREF 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 2020 *ASM,*[61] BLS employee compensation data,[62] 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 product. This value is derived from manufacturer interviews, product database analysis, and publicly available information. DOE estimates that 7.8 percent of MREFs are produced 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 products 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.

Using the GRIM, DOE estimates in the absence of amended energy conservation standards there would be 228 domestic workers for MREFs in 2029. Table V.21 shows the range of the impacts of energy conservation standards on U.S. manufacturing employment in the MREF industry. The following discussion provides a qualitative evaluation of the range of potential impacts presented in Table V.21.

TABLE V.21—DOMESTIC DIRECT EMPLOYMENT IMPACTS FOR MISCELLANEOUS REFRIGERATION PRODUCT MANUFACTURERS IN 2029

	No-new-standards case	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Direct Employment in 2029 (Production Workers + Non-Production Workers) ...	228	227	220	220	209	207
Potential Changes in Direct Employment Workers in 2029 *	....	(201) to (1)	(201) to (8)	(201) to (8)	(201) to (19)	(201) to (21)

*DOE presents a range of potential employment impacts. Numbers in parentheses denote negative values.

The direct employment impacts shown in Table V.21 represent the potential domestic employment changes that could result following the compliance date for the MREF product classes in this proposal. The upper bound estimate corresponds to a 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 products within the United States after compliance takes effect. The lower bound estimate represents the maximum decrease in production workers if manufacturing moved to lower labor-cost countries. At lower TSLs, DOE believes the likelihood of changes in production location due to amended standards are low due to the relatively minor production line updates required. However, as amended standards increase in stringency and both the complexity and cost of production facility updates increases, manufacturers are more likely to revisit their production location decisions and/or their make vs. buy decisions.

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

In interviews, manufacturers noted that the majority of MREFs—namely freestanding compact coolers—are manufactured in Asia and rebranded by home appliance manufacturers. Manufacturers had few concerns about

[61] U.S. Census Bureau, *Annual Survey of Manufactures.* ''Summary Statistics for Industry Groups and Industries in the U.S (2020).'' Available at: *www.census.gov/data/tables/time-series/econ/asm/2018-2020-asm.html* (Last accessed September 22, 2022).

[62] U.S. Bureau of Labor Statistics. *Employer Costs for Employee Compensation.* June 16, 2022. Available at: *www.bls.gov/news.release/pdf/ecec.pdf* (Last accessed September 22, 2022).

manufacturing constraints below the max-tech level and the implementation of VIPs. However, at max-tech, some manufacturers expressed technical uncertainty about industry's ability to meet the efficiencies required as few OEMs offer products at max-tech today. For example, DOE is not aware of any OEMs that currently offer freestanding compact coolers that meet TSL 5 efficiencies. DOE's shipments analysis estimates that except for built-in compact coolers, which only accounts for 4 percent of MREF shipments, no shipments of other product classes meet the max-tech efficiencies.

Some low-volume domestic and European-based OEMs offer niche or high-end MREFs (*i.e.,* built-ins, combination coolers, freestanding compact coolers that can be integrated into kitchen cabinetry). In interviews, these manufacturers stated that, due to their low volume and wide range of product offerings, they could face engineering resource constraints should amended standards necessitate a significant redesign, such as requiring insulation thickness changes or VIPs (TSL 4 for freestanding coolers and built-in coolers and TSL 5 for all other product classes). These manufacturers further stated that the extent of their resource constraints depend, in part, on the outcome of other ongoing DOE energy conservation standards rulemakings that impact related products, in particular, the potential energy conservation standards for refrigerators, refrigerator-freezers, and freezers. Pursuant to a consent decree entered on September 20, 2022, DOE has agreed to sign and post on DOE's publicly accessible website a rulemaking document for refrigerators, refrigerator-freezers, and freezers by December 30, 2023, that, when effective, would be DOE's final agency action for standards for these products.[63]

DOE seeks comment on whether manufacturers expect manufacturing capacity constraints would limit product availability to consumers in the timeframe of the amended standard compliance date (2029).

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 analyzes the impacts on small businesses in a separate analysis in section VI.B of this document as part of the Regulatory Flexibility Analysis. The manufacturers of the products covered in this rulemaking have a primary North American Industry Classification System (''NAICS'') code of 335220: ''Major Household Appliance Manufacturing'' or a secondary NAICS code of 333415: ''Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.'' The Small Business Administration (''SBA'') defines a small business as a company that has fewer than 1,500 employees and fewer than 1,250 employees for NAICS codes 335220 and 333415, respectively. DOE used the higher threshold of 1,500 employees to identify small business manufacturers. Based on this classification, DOE identified two domestic OEMs that qualify as small businesses. 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-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.

For the cumulative regulatory burden analysis, DOE examines Federal, product-specific regulations that could affect MREF manufacturers that take effect approximately three years before or after the 2029 compliance date.

TABLE V.22—COMPLIANCE DATES AND EXPECTED CONVERSION EXPENSES OF FEDERAL ENERGY CONSERVATION STANDARDS AFFECTING MISCELLANEOUS REFRIGERATION PRODUCTS ORIGINAL EQUIPMENT MANUFACTURERS

Federal energy conservation standard	Number of OEMs *	Number of OEMs affected from today's rule **	Approx. standards year	Industry conversion costs (millions $)	Industry conversion costs/product revenue *** (%)
Room Air Conditioners † 87 FR 20608 (April 7, 2022)	8	4	2026	$22.8 (2020$)	0.5
Commercial Water Heating Equipment † 87 FR 30610 (May 19, 2022)	14	1	2026	34.6 (2020$)	4.7
Consumer Furnaces † 87 FR 40590 (July 7, 2022)	15	1	2029	150.6 (2020$)	1.4
Consumer Clothes Dryers † 87 FR 51734 (August 23, 2022)	15	5	2027	149.7 (2020$)	1.8
Microwave Ovens † 87 FR 52282 (August 24, 2022)	18	7	2026	46.1 (2021$)	0.7
Consumer Conventional Cooking Products 88 FR 6818 (February 1, 2023)	34	7	2027	183.4 (2021$)	1.2
Residential Clothes Washers † 88 FR 13520 (March 3, 2023)	19	6	2027	690.8 (2021$)	5.2
Refrigerators, Refrigerator-Freezers, and Freezers † 88 FR 12452 (February 27, 2023)	49	19	2027	1,323.6 (2021$)	3.8

* This column presents the total number of OEMs identified in the energy conservation standard rule contributing to cumulative regulatory burden.
** This column presents the number of OEMs producing MREFs that are also listed as OEMs in the identified energy conservation standard contributing to cumulative regulatory burden.

[63] *Natural Resources Defense Council, Inc., et al.* v *Granholm, et al,* No. 1:20–cv–09127 (S.D.N.Y.), and *State of New York, et al.* v *Granholm, et al.* No. 1:20–cv–09362 (S.D.N.Y.).

*** 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 final rule. The conversion period typically ranges from 3 to 5 years, depending on the energy conservation standard.

† These rulemakings are in the proposed rule stage and all values are subject to change until finalized.

In addition to the rulemakings listed in Table V.29, DOE has ongoing rulemakings for other products or equipment that MREF manufacturers produce, including but not limited to automatic commercial ice makers; [64] dehumidifiers; [65] and dishwashers.[66] If DOE proposes or finalizes any energy conservation standards for these products or equipment prior to finalizing energy conservation standards MREFs, DOE will include the energy conservation standards for these other products or equipment as part of the cumulative regulatory burden for the MREF final rule.

DOE requests information regarding the impact of cumulative regulatory burden on manufacturers of MREFs associated with multiple DOE standards or product-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 MREFs, 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 (2029–2058). Table V.23 presents DOE's projections of the NES for each TSL considered for freestanding and built-in MREFs. The savings were calculated using the approach described in section IV.H.2 of this document.

TABLE V.23—CUMULATIVE NATIONAL ENERGY SAVINGS FOR MREFS; 30 YEARS OF SHIPMENTS

[2029–2058]

	TSL	Coolers	Combination coolers	Total
		(quads)		
Primary Energy	1	0.07	0.02	0.09
	2	0.15	0.03	0.19
	3	0.17	0.03	0.20
	4	0.25	0.05	0.30
	5	0.46	0.07	0.52
FFC	1	0.07	0.02	0.10
	2	0.16	0.04	0.19
	3	0.18	0.04	0.21
	4	0.26	0.05	0.31
	5	0.47	0.07	0.54

OMB Circular A–4 [67] 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.[68] The review timeframe established in EPCA is generally not synchronized with the product lifetime, product manufacturing cycles, or other factors specific to consumer MREFs. 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.24. The impacts are counted over the lifetime of consumer MREFs purchased in 2029–2037.

[64] *www.regulations.gov/docket/EERE-2017-BT-STD-0022.*

[65] *www.regulations.gov/docket/EERE-2019-BT-STD-0043.*

[66] *www.regulations.gov/docket/EERE-2019-BT-STD-0039.*

[67] U.S. Office of Management and Budget. *Circular A–4: Regulatory Analysis.* September 17, 2003. *https://obamawhitehouse.archives.gov/omb/circulars_a004_a-4/* (last accessed September 30, 2022).

[68] Section 325(m) of 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. 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.24—CUMULATIVE NATIONAL ENERGY SAVINGS FOR MREFS; 9 YEARS OF SHIPMENTS
[2029–2037]

	TSL	Coolers	Combination coolers	Total
		(quads)		
Primary Energy	1	0.02	0.01	0.03
	2	0.04	0.01	0.05
	3	0.05	0.01	0.06
	4	0.07	0.01	0.08
	5	0.12	0.02	0.14
FFC	1	0.02	0.01	0.03
	2	0.04	0.01	0.05
	3	0.05	0.01	0.06
	4	0.07	0.01	0.09
	5	0.13	0.02	0.15

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 MREFs. In accordance with OMB's guidelines on regulatory analysis,[69] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V.25 shows the consumer NPV results with impacts counted over the lifetime of products purchased in 2029–2058.

TABLE V.25—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR MREFS; 30 YEARS OF SHIPMENTS (2029–2058)
[Million $2021]

	TSL	Coolers	Combination coolers	Total
3% Discount Rate	1	348.5	143.4	492.0
	2	460.4	207.3	667.6
	3	610.3	207.3	817.5
	4	547.4	143.4	690.9
	5	(1061.9)	(296.0)	(1357.9)
7% Discount Rate	1	127.1	56.3	183.5
	2	126.7	80.8	207.5
	3	189.7	80.8	270.5
	4	97.8	37.6	135.3
	5	(848.7)	(195.3)	(1044.0)

Note: Numbers in parentheses denote negative values.

The NPV results based on the aforementioned 9-year analytical period are presented in Table V.26. The impacts are counted over the lifetime of products purchased in 2029–2037. 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.

TABLE V.26—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR MREFS; 9 YEARS OF SHIPMENTS (2029–2037)
[Million $2021]

	TSL	Coolers	Combination coolers	Total
3% Discount Rate	1	130.2	54.1	184.3
	2	162.7	78.1	240.7
	3	222.1	78.1	300.1
	4	180.0	40.9	220.
	5	(484.1)	(132.2)	(616.3)
7% Discount Rate	1	63.5	28.5	92.0
	2	58.6	40.7	99.4
	3	91.9	40.7	132.7
	4	36.9	12.3	49.1

[69] U.S. Office of Management and Budget. *Circular A–4: Regulatory Analysis.* September 17, 2003. *https://obamawhitehouse.archives.gov/omb/circulars_a004_a-4/* (last accessed September 30, 2022).

TABLE V.26—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR MREFS; 9 YEARS OF SHIPMENTS (2029–2037)—Continued

[Million $2021]

	TSL	Coolers	Combination coolers	Total
	5	(465.5)	(108.9)	(574.4)

The previous results reflect the use of a default trend to estimate the change in price for consumer MREFs over the analysis period (see section IV.H.3 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

It is estimated that that amended energy conservation standards for MREFs 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 (2029–2033), 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 MREFs 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 MREFs is expected to yield environmental benefits in the form of reduced emissions of certain air pollutants and greenhouse gases. Table V.27 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.27—CUMULATIVE EMISSIONS REDUCTION FOR MREFS SHIPPED IN 2029–2058

	Trial standard level				
	1	2	3	4	5
Power Sector Emissions					
CO_2 (*million metric tons*)	3.0	6.0	6.6	9.7	16.9
CH_4 (*thousand tons*)	0.2	0.5	0.5	0.8	1.3
N_2O (*thousand tons*)	0.03	0.07	0.07	0.11	0.19
NO_X (*thousand tons*)	1.5	3.0	3.3	4.8	8.4
SO_2 (*thousand tons*)	1.5	3.0	3.2	4.7	8.3
Hg (*tons*)	0.01	0.02	0.02	0.03	0.05

TABLE V.27—CUMULATIVE EMISSIONS REDUCTION FOR MREFS SHIPPED IN 2029–2058—Continued

	Trial standard level				
	1	2	3	4	5
Upstream Emissions					
CO_2 (*million metric tons*)	0.2	0.5	0.5	0.7	1.3
CH_4 (*thousand tons*)	21.7	43.4	47.5	69.5	121.4
N_2O (*thousand tons*)	0.00	0.00	0.00	0.00	0.01
NO_X (*thousand tons*)	3.5	7.0	7.6	11.1	19.4
SO_2 (*thousand tons*)	0.02	0.03	0.03	0.05	0.09
Hg (*tons*)	0.00	0.00	0.00	0.00	0.00
Total FFC Emissions					
CO_2 (*million metric tons*)	3.3	6.5	7.1	10.4	18.2
CH_4 (*thousand tons*)	22.0	43.9	48.0	70.3	122.7
N_2O (*thousand tons*)	0.03	0.07	0.08	0.11	0.19
NO_X (*thousand tons*)	5.0	10.0	10.9	15.9	27.9
SO_2 (*thousand tons*)	1.5	3.0	3.3	4.8	8.4
Hg (*tons*)	0.01	0.02	0.02	0.03	0.05

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 MREFs. Section IV.L of this document discusses the SC–CO_2 values that DOE used. Table V.28 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.28—PRESENT MONETIZED VALUE OF CO_2 EMISSIONS REDUCTION FOR MREFS SHIPPED IN 2029–2058

[Million 2021$]

TSL	SC–CO_2 Case (Discount rate and statistics)			
	5% (Average)	3% (Average)	2.5% (Average)	3% (95th Percentile)
1	27.4	121.9	192.4	369.7
2	54.9	244.0	385.2	740.2
3	59.6	265.3	418.9	804.8
4	87.1	387.7	612.4	1176.1
5	152.1	677.7	1,070.6	2,055.8

As discussed in section IV.L.1 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 MREFs. Table V.29 presents the value of the CH_4 emissions reduction at each TSL, and Table V.30 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.29—PRESENT MONETIZED VALUE OF METHANE EMISSIONS REDUCTION FOR MREFS SHIPPED IN 2029–2058

[Million 2021$]

TSL	SC–CH_4 case (Discount rate and statistics)			
	5% (Average)	3% (Average)	2.5% (Average)	3% (95th Percentile)
1	8.5	26.5	37.4	70.1
2	17.1	53.1	74.8	140.4
3	18.6	57.8	81.5	152.8
4	27.1	84.6	119.2	223.5
5	47.4	147.9	208.6	391.0

TABLE V.30—PRESENT MONETIZED VALUE OF NITROUS OXIDE EMISSIONS REDUCTION FOR MREFs SHIPPED IN 2029–2058

[Million 2021$]

TSL	SC–N_2O case (Discount rate and statistics)			
	5% (Average)	3% (Average)	2.5% (Average)	3% (95th Percentile)
1	0.1	0.5	0.7	1.2
2	0.2	0.9	1.4	2.5
3	0.2	1.0	1.6	2.7
4	0.4	1.5	2.3	3.9
5	0.6	2.6	4.0	6.8

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 MREFs. The dollar-per-ton values that DOE used are discussed in section IV.L of this document. Table V.31 presents the present value for NO_X emissions reduction for each TSL calculated using 7-percent and 3-percent discount rates, and Table V.32 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.31—PRESENT MONETIZED VALUE OF NO_X EMISSIONS REDUCTION FOR MREFs SHIPPED IN 2029–2058

[Million 2021$]

TSL	3% Discount rate	7% Discount rate
1	181.8	65.7
2	363.8	131.4
3	395.8	142.4
4	578.3	207.5
5	1,009.8	361.4

TABLE V.32—PRESENT MONETIZED VALUE OF SO_2 EMISSIONS REDUCTION FOR MREFs SHIPPED IN 2029–2058

[Million 2021$]

TSL	3% Discount rate	7% Discount rate
1	73.7	27.1
2	147.4	54.1
3	160.4	58.7
4	234.2	85.4
5	408.7	148.6

DOE has not considered the monetary benefits of the reduction of Hg for this proposed rule. Not all the public health and environmental benefits from the reduction of greenhouse gases, NO_X, 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 Hg, direct particulate matter (''PM''), and other co-pollutants may be significant. The energy savings from this proposal reduces electricity use and therefore reduces the need for electricity generation. To the extent that the reduced generation includes a reduction in combustion of coal, this rule will also include health benefits derived from emission reductions of mercury and particulate matter.

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.33 presents 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 MREFs, and are measured for the lifetime of products shipped in 2029–2058. 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 MREFs shipped in 2029–2058.

TABLE V.33—CONSUMER NPV COMBINED WITH PRESENT MONETIZED VALUE OF CLIMATE BENEFITS AND HEALTH BENEFITS

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
3% Discount rate for Consumer NPV and Health Benefits (billion 2021$)					
5% Average SC–GHG case	0.8	1.3	1.5	1.6	0.3
3% Average SC–GHG case	0.9	1.5	1.7	2.0	0.9

TABLE V.33—CONSUMER NPV COMBINED WITH PRESENT MONETIZED VALUE OF CLIMATE BENEFITS AND HEALTH BENEFITS—Continued

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
2.5% Average SC–GHG case	1.0	1.6	1.9	2.2	1.3
3% 95th percentile SC–GHG case	1.2	2.1	2.3	2.9	2.5
7% Discount rate for Consumer NPV and Health Benefits (billion 2021$)					
5% Average SC–GHG case	0.3	0.5	0.6	0.5	−0.3
3% Average SC–GHG case	0.4	0.7	0.8	0.9	0.3
2.5% Average SC–GHG case	0.5	0.9	1.0	1.2	0.7
3% 95th percentile SC–GHG case	0.7	1.3	1.4	1.8	1.9

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. 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. 6295(o)(3)(B))

For this NOPR, DOE considered the impacts of amended standards for MREFs 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. In addition, as discussed in section V.B.1.b of this document, DOE conducted a subgroup analysis for seniors, the results of which are comparable to all MREF consumers (see Table V.18.) DOE did not consider low-income consumers in this NOPR because MREFs are not products generally used by this subgroup, as they typically cost more than comparable compact refrigerators, which are able to maintain lower temperatures compared to MREFs, and therefore serve a wider range of applications.

DOE also notes that the economics literature provides a wide-ranging discussion of how consumers trade off upfront costs and energy savings in the absence of government intervention. Much of this literature attempts to explain why consumers appear to undervalue energy efficiency improvements. There is evidence that consumers undervalue future energy savings as a result of (1) a lack of information, (2) a lack of sufficient salience of the long-term or aggregate benefits, (3) a lack of sufficient savings to warrant delaying or altering purchases, (4) excessive focus on the short term, in the form of inconsistent weighting of future energy cost savings relative to available returns on other investments, (5) computational or other difficulties associated with the evaluation of relevant tradeoffs, and (6) a divergence in incentives (for example, between renters and owners, or builders and purchasers). Having less than perfect foresight and a high degree of uncertainty about the future, consumers may trade off these types of investments at a higher-than-expected rate between current consumption and uncertain future energy cost savings.

In DOE's current regulatory analysis, potential changes in the benefits and costs of a regulation due to changes in consumer purchase decisions are included in two ways. First, if consumers forego the purchase of a product in the standards case, this decreases sales for product manufacturers, and the impact on manufacturers attributed to lost revenue is included in the MIA. Second, DOE accounts for energy savings attributable only to products actually used by consumers in the standards case; if a standard decreases the number of products purchased by consumers, this decreases the potential energy savings from an energy conservation standard. DOE provides estimates of shipments and changes in the volume of product purchases in chapter 9 of the NOPR TSD. However, DOE's current analysis does not explicitly control for heterogeneity in consumer preferences, preferences across subcategories of products or specific features, or consumer price sensitivity variation according to household income.[70]

While DOE is not prepared at present to provide a fuller quantifiable framework for estimating the benefits and costs of changes in consumer purchase decisions due to an energy conservation standard, DOE is committed to developing a framework that can support empirical quantitative tools for improved assessment of the consumer welfare impacts of appliance standards. DOE has posted a paper that discusses the issue of consumer welfare impacts of appliance energy conservation standards, and potential enhancements to the methodology by which these impacts are defined and estimated in the regulatory process.[71] DOE welcomes comments on how to more fully assess the potential impact of energy conservation standards on consumer choice and how to quantify this impact in its regulatory analysis in future rulemakings.

1. Benefits and Burdens of TSLs Considered for MREF Standards

Table V.34 and Table V.35 summarize the quantitative impacts estimated for each TSL for MREFs. The national impacts are measured over the lifetime

[70] P.C. Reiss and M.W. White. Household Electricity Demand, Revisited. *Review of Economic Studies.* 2005. 72(3): pp. 853–883. doi: *10.1111/0034-6527.00354.*

[71] Sanstad, A.H. *Notes on the Economics of Household Energy Consumption and Technology Choice.* 2010. Lawrence Berkeley National Laboratory. *www1.eere.energy.gov/buildings/appliance_standards/pdfs/consumer_ee_theory.pdf* (last accessed September 22, 2022).

of MREFs purchased in the 30-year period that begins in the anticipated year of compliance with amended standards (2029–2058). The energy savings, emissions reductions, and value of emissions reductions refer to full-fuel-cycle results. The efficiency levels contained in each TSL are described in section I.A of this document.

TABLE V.34—SUMMARY OF ANALYTICAL RESULTS FOR MISCELLANEOUS REFRIGERATION PRODUCT TSLS: NATIONAL IMPACTS

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Cumulative FFC National Energy Savings					
Quads	0.10	0.19	0.21	0.31	0.54
Cumulative FFC Emissions Reduction					
CO_2 (*million metric tons*)	3.3	6.5	7.1	10.4	18.2
CH_4 (*thousand tons*)	22.0	43.9	48.0	70.3	122.7
N_2O (*thousand tons*)	0.03	0.07	0.08	0.11	0.19
NO_X (*thousand tons*)	5.0	10.0	10.9	15.9	27.9
SO_2 (*thousand tons*)	1.5	3.0	3.3	4.8	8.4
Hg (*tons*)	0.01	0.02	0.02	0.03	0.05
Present Monetized Value of Benefits and Costs (*3% discount rate, billion 2021$*)					
Consumer Operating Cost Savings	0.6	1.3	1.4	2.0	3.5
Climate Benefits *	0.1	0.3	0.3	0.5	0.8
Health Benefits **	0.3	0.5	0.6	0.8	1.4
Total Monetized Benefits †	1.0	2.1	2.3	3.3	5.8
Consumer Incremental Product Costs	0.1	0.6	0.6	1.3	4.9
Consumer Net Benefits	0.5	0.7	0.8	0.7	−1.4
Total Net Monetized Benefits	0.9	1.5	1.7	2.0	0.9
Present Monetized Value of Benefits and Costs (*7% discount rate, billion 2021$*)					
Consumer Operating Cost Savings	0.3	0.5	0.6	0.8	1.4
Climate Benefits *	0.1	0.3	0.3	0.5	0.8
Health Benefits **	0.1	0.2	0.2	0.3	0.5
Total Monetized Benefits †	0.5	1.0	1.1	1.6	2.7
Consumer Incremental Product Costs	0.1	0.3	0.3	0.7	2.5
Consumer Net Benefits	0.2	0.2	0.3	0.1	−1.0
Total Net Monetized Benefits	0.4	0.7	0.8	0.9	0.3

Note: This table presents the costs and benefits associated with consumer MREFs shipped in 2029–2058. These results include benefits to consumers which accrue after 2058 from the products shipped in 2029–2058.

* 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, but the Department does not have a single central SC–GHG point estimate. On March 16, 2022, the Fifth Circuit Court of Appeals (No. 22–30087) granted the Federal government's emergency motion for stay pending appeal of the February 11, 2022, preliminary injunction issued in *Louisiana* v. *Biden,* No. 21–cv–1074–JDC–KK (W.D. La.). As a result of the Fifth Circuit's order, the preliminary injunction is no longer in effect, pending resolution of the Federal government's appeal of that injunction or a further court order. Among other things, the preliminary injunction enjoined the defendants in that case from ''adopting, employing, treating as binding, or relying upon'' the interim estimates of the social cost of greenhouse gases—which were issued by the Interagency Working Group on the Social Cost of Greenhouse Gases on February 26, 2021—to monetize the benefits of reducing greenhouse gas emissions. As reflected in this rule, DOE has reverted to its approach prior to the injunction and presents monetized GHG abatement benefits where appropriate and permissible under law.

** 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, but the Department does not have a single central SC–GHG point estimate. DOE emphasizes the importance and value of considering the benefits calculated using all four SC–GHG estimates.

TABLE V.35—SUMMARY OF ANALYTICAL RESULTS FOR MISCELLANEOUS REFRIGERATION PRODUCTS TSLS: MANUFACTURER AND CONSUMER IMPACTS

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Manufacturer Impacts					
Industry NPV (*million 2021$*) (No-new-standards case INPV = $742.0)	711.3 to 714.7	695.4 to 706.2	697.3 to 706.6	652.3 to 679.4	356.7 to 458.8
Industry NPV (*% change*)	(4.1) to (3.7)	(6.3) to (4.8)	(6.0) to (4.8)	(12.1) to (8.4)	(51.9) to (38.2)
Consumer Average LCC Savings (2021$)					
FCC	17.4	17.2	17.2	12.6	−45.3

TABLE V.35—SUMMARY OF ANALYTICAL RESULTS FOR MISCELLANEOUS REFRIGERATION PRODUCTS TSLs: MANUFACTURER AND CONSUMER IMPACTS—Continued

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
FC	23.5	23.5	47.2	28.0	−178.8
BICC	17.2	2.9	2.9	2.9	−80.9
BIC	20.3	21.2	57.3	57.3	−197.4
C–13A	24.8	35.5	35.5	12.0	−73.4
C–13A–BI	27.6	39.6	39.6	15.3	−74.6
C–3A	31.5	31.5	31.5	31.5	−233.4
C–3A–BI	36.7	36.7	36.7	36.7	−240.7
Shipment-Weighted Average *	19.6	20.9	25.0	15.6	−74.0
Simple Payback Period (years)					
FCC	2.0	5.0	5.0	6.8	11.5
FC	5.8	5.8	3.8	8.0	22.5
BICC	2.4	7.9	7.9	7.9	13.8
BIC	6.4	8.6	4.0	4.0	23.6
C–13A	1.1	1.4	1.4	6.9	16.7
C–13A–BI	1.1	1.3	1.3	6.7	16.3
C–3A	1.7	1.7	1.7	1.7	41.9
C–3A–BI	1.6	1.6	1.6	1.6	38.7
Shipment-Weighted Average *	2.5	4.7	4.3	6.9	14.4
Percent of Consumers with Net Cost					
FCC	2.8	33.5	33.5	49.5	77.8
FC	8.8	8.8	1.6	45.5	94.5
BICC	1.0	15.3	15.3	15.3	22.7
BIC	18.7	53.4	3.6	3.6	94.3
C–13A	0.3	1.0	1.0	47.5	90.3
C–13A–BI	0.3	0.7	0.7	44.4	89.7
C–3A	0.0	0.0	0.0	0.0	99.4
C–3A–BI	0.0	0.0	0.0	0.03	98.9
Shipment-Weighted Average *	3.5	24.7	22.1	45.5	80.8

Parentheses indicate negative (-) values. The entry "N/A" 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 2029.

DOE first considered TSL 5, which represents the max-tech efficiency levels. For coolers (*i.e.,* FCC, FC, BICC, and BIC), which account for approximately 82 percent of MREF shipments-size, DOE expects that products would require use of VIPs, VSCs, and triple-glazed doors at this TSL. DOE expects that VIPs would be used in the products' side walls. In addition, the products would use the best-available-efficiency variable-speed compressors, forced-convection heat exchangers with multi-speed brushless-DC ("BLDC") fans, and increase in cabinet wall thickness as compared to most baseline products. TSL 5 would save an estimated 0.54 quads of energy, an amount which DOE considers significant. Under TSL 5, the NPV of consumer benefit would be negative, *i.e.,* −$1.04 billion using a discount rate of 7 percent, and −$1.36 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 5 are 18.2 Mt of CO_2, 8.4 thousand tons of SO_2, 27.9 thousand tons of NO_X, 0.05 tons of Hg, 123 thousand tons of CH_4, and 0.19 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 5 is $0.8 billion. The estimated monetary value of the health benefits from reduced SO_2 and NO_X emissions at TSL 5 is $0.5 billion using a 7-percent discount rate and $1.4 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 5 is $0.3 billion. Using a 3-percent discount rate for all benefits and costs, the estimated total NPV at TSL 5 is $0.9 billion. The estimated total monetized NPV is provided for additional information, however, consistent with the statutory factors and framework for determining whether a proposed standard level is economically justified, DOE considers a range of quantitative and qualitative benefits and burdens, including the costs and cost savings for consumers, impacts to consumer subgroups, energy savings, emission reductions, and impacts on manufacturers.

At TSL 5, for the product classes with the largest market share, which are FCC, FC, and C–13A and together account for approximately 92 percent of annual shipments, the LCC savings are all negative (−$45.3, −$178.8, and −$73.4, respectively) and their payback periods are 11.5 years, 22.5, and 16.7 years, respectively, which are all longer than their corresponding average lifetimes. For these product classes, the fraction of consumers experiencing a net LCC cost is 77.8 percent, 94.5 percent, and 90.3 percent due to increases in first cost of $180.0, $335.6, and $73.4, respectively. Overall, a majority of MREF consumers (80.8 percent) would experience a net cost and the average LCC savings would be negative for all analyzed product classes.

At TSL 5, the projected change in INPV ranges from a decrease of $385.3 million to a decrease of $283.2 million, which corresponds to decreases of 51.9 percent and 38.2 percent, respectively. DOE estimates that industry must invest $539.0 million to comply with standards set at TSL 5.

DOE estimates that approximately 2.7 percent of current MREF shipments meet the max-tech levels. For FCC, FC, and C–13A, which together account for approximately 92 percent of annual shipments, DOE estimates that zero shipments currently meet max-tech efficiencies.

At TSL 5, manufacturers would likely need to implement all the most efficient design options analyzed in the engineering analysis. Manufacturers that do not currently offer products that meet TSL 5 efficiencies would need to develop new product platforms, which would require significant investment. Conversion costs are driven by the need for changes to cabinet construction, such as increasing foam insulation thickness and/or incorporating VIP technology. Increasing insulation thickness would likely result in the loss of interior volume and would require redesign of the cabinet as well as the designs and tooling associated with the interior of the product, such as the liner, shelving, racks, and drawers. Incorporating VIPs into MREF designs could also require redesign of the cabinet in order to maximize the efficiency benefit of this technology. In addition to insulation changes, manufacturers may need to implement triple-pane glass, which could require implementing reinforced hinges and redesigning the door structure.

At this level, DOE expects an estimated 20-percent drop in shipments in the year the standard takes effect, as some consumers may forgo purchasing a new MREF due to the increased upfront cost of baseline models.

The Secretary tentatively concludes that at TSL 5 for MREFs, the benefits of energy savings, positive NPV of consumer benefits, emission reductions, and the estimated monetary value of the emissions reductions would be outweighed by the economic burden on many consumers, and the impacts on manufacturers, including the significant potential reduction in INPV. A majority of MREF consumers (80.8 percent) would experience a net cost and the average LCC savings would be negative. Additionally, manufacturers would need to make significant upfront investments to update product platforms. The potential reduction in INPV could be as high as 51.9 percent. Consequently, the Secretary has tentatively concluded that TSL 5 is not economically justified.

DOE then considered TSL 4, which represents EL 3 for all analyzed product classes except for C–3A and C–3A–BI, for which this TSL corresponds to EL 1 and BIC, for which this TSL corresponds to EL 2. At TSL 4, products of most classes would use high-efficiency single-speed compressors with forced-convection evaporators and condensers using brushless DC fan motors. Doors would be double-glazed with low-conductivity gas fill (*e.g.,* argon) and a single low-emissivity glass layer. Products would not require use of VIPs, but the FC product class would require thicker walls than corresponding baseline products. TSL 4 would save an estimated 0.31 quads of energy, an amount DOE considers significant. Under TSL 4, the NPV of consumer benefit would be $0.14 billion using a discount rate of 7 percent, and $0.69 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 4 are 10.4 Mt of CO_2, 4.8 thousand tons of SO_2, 15.9 thousand tons of NO_X, 0.03 tons of Hg, 70.3 thousand tons of CH_4, and 0.11 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 4 is $0.5 billion. The estimated monetary value of the health benefits from reduced SO_2 and NO_X emissions at TSL 4 is $0.3 billion using a 7-percent discount rate and $0.8 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 4 is $0.9 billion. Using a 3-percent discount rate for all benefits and costs, the estimated total NPV at TSL 4 is $2.0 billion. The estimated total monetized NPV is provided for additional information, however, consistent with the statutory factors and framework for determining whether a proposed standard level is economically justified, DOE considers a range of quantitative and qualitative benefits and burdens, including the costs and cost savings for consumers, impacts to consumer subgroups, energy savings, emission reductions, and impacts on manufacturers.

At TSL 4, for the product classes with the largest market share, which are FCC, FC, and C–13A, the LCC savings are $12.6, $28.0, and $12.0, respectively, and their payback periods are 6.8 years, 8.0, and 6.9 years, respectively, which are all shorter than their corresponding average lifetimes. For these product classes, the fraction of consumers experiencing a net LCC cost is 49.5 percent, 45.5 percent, and 47.5 percent, and increases in first cost for these classes are $52.9, $96.0, and $44.3, respectively. Overall, the LCC savings would be positive for all MREF product classes, and more than half of MREF consumers would experience a net benefit (51 percent).

At TSL 4, the projected change in INPV ranges from a decrease of $89.8 million to a decrease of $62.7 million, which correspond to decreases of 12.1 percent and 8.4 percent, respectively. DOE estimates that industry must invest $126.9 million to comply with standards set at TSL 4.

DOE estimates that approximately 3.4 percent of shipments currently meet the required efficiencies at TSL 4 as at max-tech. For most product classes (*i.e.,* FCC, BICC, BIC, C–13A, C–13A–BI, C–3A, C–3A–BI), DOE expects manufacturers could reach the required efficiencies with relatively straightforward component swaps, such as implementing incrementally more efficient compressors, rather than the full platform redesigns required at max-tech. DOE expects that FC manufacturers would need to increase foam insulation thickness and incorporate variable-speed compressor systems at this level. At TSL 4, DOE expects an estimated 10-percent drop in shipments in the year the standard takes effect, as some consumers may forgo purchasing a new MREF due to the increased upfront cost of baseline models.

After considering the analysis and weighing the benefits and burdens, the Secretary has tentatively concluded that at a standard set at TSL 4 for MREFs would be economically justified. At this TSL, the average LCC savings are positive for all product classes for which an amended standard is considered, with a shipment-weighted average of $15.60 in consumer savings.

The FFC national energy savings are significant and the NPV of consumer benefits is positive (and represents the maximum value) using both a 3-percent and 7-percent discount rate. Notably, the benefits to consumers outweigh the cost to manufacturers. At TSL 4, the NPV of consumer benefits, even measured at the more conservative discount rate of 7 percent is over 1.5 times higher than the maximum estimated manufacturers' loss in INPV. The standard levels at TSL 4 are economically justified even without weighing the estimated monetary value of emissions reductions. When those emissions reductions are included—representing $0.5 billion in climate benefits (associated with the average SC–GHG at a 3-percent discount rate), and $0.8 billion (using a 3-percent discount rate) or $0.3 billion (using a 7-percent discount rate) in health benefits—the rationale becomes stronger still.

As stated, DOE conducts the walk-down analysis to determine the TSL that represents the maximum improvement in energy efficiency that is technologically feasible and economically justified as required under EPCA. The walk-down is not a comparative analysis, as a comparative analysis would result in the maximization of net benefits instead of energy savings that are technologically feasible and economically justified, which would be contrary to the statute. 86 FR 70892, 70908. Although DOE has not conducted a comparative analysis to select the proposed energy conservation standards, DOE notes that TSL 4 represents the option with positive LCC savings ($15.6) for all product classes compared to TSL 5 ($−74.0). Further, when comparing the cumulative NPV of consumer benefit using a 7% discount rate, TSL 4 ($0.14 billion) has a higher benefit value than TSL 5 (−$1.04 billion), while for a 3% discount rate, TSL 4 ($0.69 billion) is also higher than TSL 5 (−1.36 billion), which yields negative NPV in both cases. These additional savings and benefits at TSL 4 are significant. DOE considers the impacts to be, as a whole, economically justified at TSL 4.

Although DOE considered proposed amended standard levels for MREFs by grouping the efficiency levels for each product class into TSLs, DOE evaluates all analyzed efficiency levels in its analysis. For all product classes, the proposed standard level represents the maximum energy savings that does not result in negative LCC savings. The ELs at the proposed standard level result in positive LCC savings for all product classes, and reduce the decrease in INPV and conversion costs to the point where DOE has tentatively concluded they are economically justified, as discussed for TSL 4 in the preceding paragraphs.

Therefore, based on the previous considerations, DOE proposes to adopt the energy conservation standards for MREFs at TSL 4. The proposed amended energy conservation standards for MREFs, which are expressed in kWh/yr, are shown in Table V.36.

TABLE V.36—PROPOSED AMENDED ENERGY CONSERVATION STANDARDS FOR MREF

Product class	Equations for maximum energy use (kWh/yr)
1. Freestanding compact coolers (“FCC”)	5.52AV + 109.1
2. Freestanding coolers (“FC”)	5.52AV + 109.1
3. Built-in compact coolers (“BICC”)	5.52AV + 109.1
4. Built-in coolers (“BIC”)	6.30AV + 124.6
C–3A. Cooler with all-refrigerator—automatic defrost	4.11AV + 117.4
C–3A–BI. Built-in cooler with all-refrigerator—automatic defrost	4.67AV + 133.0
C–5–BI. Built-in cooler with refrigerator-freezer—automatic defrost with bottom-mounted freezer	5.47AV + 196.2 + 28I
C–9. Cooler with upright freezer with automatic defrost without an automatic icemaker	5.58AV + 147.7 + 28I
C–9–BI. Built-in cooler with upright freezer with automatic defrost without an automatic icemaker	6.38AV + 168.8 + 28I
C–13A. Compact cooler with all-refrigerator—automatic defrost	4.74AV + 155.0
C–13A–BI. Built-in compact cooler with all-refrigerator—automatic defrost	5.22AV + 170.5

AV = Total adjusted volume, expressed in ft^3, as determined in appendix A to subpart B of 10 CFR part 430.
I = 1 for a product with an automatic icemaker and = 0 for a product without an automatic icemaker.

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 2021$) 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.37 shows the annualized values for MREFs under TSL 4, expressed in 2021$. The results under the primary estimate are as follows.

Using a 7-percent discount rate for consumer benefits and costs and NO_X and SO_2 reduction benefits, and a 3-percent discount rate case for GHG social costs, the estimated cost of the proposed standards for MREFs is $81.2 million per year in increased equipment costs, while the estimated annual benefits are $97.6 million from reduced equipment operating costs, $28.9 million from GHG reductions, and $35.4 million from reduced NO_X and SO_2 emissions. In this case, the net benefit amounts to $80.6 million per year.

Using a 3-percent discount rate for all benefits and costs, the estimated cost of the proposed standards for MREFs is $81.0 million per year in increased equipment costs, while the estimated annual benefits are $123.1 million in reduced operating costs, $28.9 million from GHG reductions, and $49.5 million from reduced NO_X and SO_2 emissions. In this case, the net benefit amounts to $120.4 million per year.

TABLE V.37—ANNUALIZED MONETIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR MREFS (TSL 4)

[Million 2021$/year]

	Primary estimate	Low-net-benefits estimate	High-net-benefits estimate
3% discount rate			
Consumer Operating Cost Savings	123.1	116.3	131.2
Climate Benefits *	28.9	28.1	29.6
Health Benefits **	49.5	48.2	50.8
Total Monetized Benefits †	201.4	192.6	211.6
Consumer Incremental Product Costs ‡	81.0	82.3	79.4

TABLE V.37—ANNUALIZED MONETIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR MREFS (TSL 4)—Continued

[Million 2021$/year]

	Primary estimate	Low-net-benefits estimate	High-net-benefits estimate
Net Monetized Benefits	120.4	110.3	132.2
7% discount rate			
Consumer Operating Cost Savings	97.6	92.7	103.3
Climate Benefits * (3% discount rate)	28.9	28.1	29.6
Health Benefits **	35.4	34.6	36.2
Total Monetized Benefits †	161.9	155.4	169.2
Consumer Incremental Product Costs	81.2	82.4	79.8
Net Monetized Benefits	80.6	72.9	89.4

Note: This table presents the costs and benefits associated with refrigerators, refrigerator-freezers, and freezers shipped in 2029–2058. These results include benefits to consumers which accrue after 2056 from the products shipped in 2029–2058. The Primary, Low-Net-Benefits, and High Net Benefits Estimates utilize projections of energy prices from the *AEO2022* 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 section 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, but the Department 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 SC–GHG estimates. On March 16, 2022, the Fifth Circuit Court of Appeals (No. 22–30087) granted the Federal government's emergency motion for stay pending appeal of the February 11, 2022, preliminary injunction issued in *Louisiana* v. *Biden,* No. 21–cv–1074–JDC–KK (W.D. La.). As a result of the Fifth Circuit's order, the preliminary injunction is no longer in effect, pending resolution of the Federal government's appeal of that injunction or a further court order. Among other things, the preliminary injunction enjoined the defendants in that case from "adopting, employing, treating as binding, or relying upon" the interim estimates of the social cost of greenhouse gases—which were issued by the Interagency Working Group on the Social Cost of Greenhouse Gases on February 26, 2021—to monetize the benefits of reducing greenhouse gas emissions. As reflected in this rule, DOE has reverted to its approach prior to the injunction and presents monetized GHG abatement benefits where appropriate and permissible under law.

** 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. 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 benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate, but the Department does not have a single central SC–GHG point estimate.

D. Reporting, Certification, and Sampling Plan

Manufacturers, including importers, must use product-specific certification templates to certify compliance to DOE. For MREFs, the certification template reflects the general certification requirements specified at 10 CFR 429.12 and the product-specific requirements specified at 10 CFR 429.14. As discussed in the previous paragraphs, DOE is not proposing to amend the product-specific certification requirements for these products.

VI. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866 and 13563

Executive Order ("E.O.") 12866, "Regulatory Planning and Review," 58 FR 51734 (Oct. 4, 1993) as supplemented and reaffirmed by E.O. 13563, "Improving Regulation and Regulatory Review," 76 FR 3821 (January 21, 2011), 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/final 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 proposed 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 proposed 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 TSD 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 (*www.energy.gov/gc/office-general-counsel*). DOE has prepared the following IRFA for the products that are the subject of this proposed rulemaking.

For manufacturers of miscellaneous refrigeration products (''MREFs''), 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.* The manufacturing of the products covered in this rulemaking are classified under NAICS code 335220: ''Major Household Appliance Manufacturing'' or NAICS code 333415: ''Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.'' The SBA sets a threshold of 1,500 employees or fewer and 1,250 employees or fewer for an entity to be considered as a small business for NAICS codes 335220 and 333415, respectively. DOE used the higher threshold of 1,500 employees to identify small business manufacturers.

1. Description of Reasons Why Action Is Being Considered

DOE is proposing amended energy conservation standards for MREFs. EPCA authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. Title III, Part B of EPCA established the Energy Conservation Program for Consumer Products Other Than Automobiles which, in addition to identifying particular consumer products and commercial equipment as covered under the statute, permits the Secretary of Energy to classify additional types of consumer products as covered products. (42 U.S.C. 6292(a)(20)) DOE added MREFs as covered products through a final determination of coverage published in the **Federal Register** on July 18, 2016. 81 FR 46768. 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. 6295(m)(1)) 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 B of EPCA established the Energy Conservation Program for Consumer Products Other Than Automobiles which, in addition to identifying particular consumer products and commercial equipment as covered under the statute, permits the Secretary of Energy to classify additional types of consumer products as covered products. (42 U.S.C. 6292(a)(20)) DOE added MREFs as covered products through a final determination of coverage published in the **Federal Register** on July 18, 2016. 81 FR 46768. MREFs are consumer refrigeration products other than refrigerators, refrigerator-freezers, or freezers, which include coolers and combination cooler refrigeration products. 10 CFR 430.2. MREFs include refrigeration products such as coolers (*e.g.,* wine chillers and other specialty products) and combination cooler refrigeration products (*e.g.,* wine chillers and other specialty compartments combined with a refrigerator, refrigerator-freezers, or freezers).

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. 6295(m)(1)) Not later than three years after issuance of a final determination not to amend standards, 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. 6295(m)(3)(B))

3. Description on Estimated Number of Small Entities Regulated

DOE reviewed this proposed rule under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003. 68 FR 7990. DOE conducted a market survey to identify potential small manufacturers of MREFs. DOE began its assessment by reviewing DOE's CCD,[72] California Energy Commission's Modernized Appliance Efficiency Database System (''MAEDbS''),[73] individual company websites, and prior MREF rulemakings to identify manufacturers of the covered product. 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,[74]) and basic model numbers, to identify original equipment manufacturers (''OEMs'') of covered MREFs. DOE further relied on public data and subscription-based market research tools (*e.g.,* Dun & Bradstreet reports)[75] to determine company, location, headcount, and annual revenue. DOE also asked industry representatives if they were aware of any small manufacturers during manufacturer interviews. DOE screened out companies that do not offer products covered by this rulemaking, do not meet the SBA's definition of a ''small business,'' or are foreign-owned and operated.

DOE initially identified 38 OEMs that sell MREFs in the United States. Of the 38 OEMs identified, DOE tentatively

[72] 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 May 2, 2022).

[73] California Energy Commission's Modernized Appliance Efficiency Database System is available at: *cacertappliances.energy.ca.gov/Pages/ApplianceSearch.aspx* (Last accessed May 2, 2022).

[74] S&P Global. Panjiva Market Intelligence is available at: *panjiva.com/import-export/United-States* (Last accessed May 5, 2022).

[75] D&B Hoovers | Company Information | Industry Information | Lists, *app.dnbhoovers.com/* (Last accessed May 5, 2022).

determined that two companies qualify as small businesses and are not foreign-owned and operated.

DOE reached out to both small businesses and invited them to participate in voluntary interviews. Neither of the small business consented to participate in formal MIA interviews. DOE also requested information about small businesses and potential impacts on small businesses while interviewing larger manufacturers.

4. Description and Estimate of Compliance Requirements Including Differences in Cost, if Any, for Different Groups of Small Entities

One of the small businesses identified has 14 MREF models certified in DOE's CCD. Of those 14 models, nine models are FCC, two are BIC, and three are C–13A combination coolers. None of the nine FCC models meet the TSL 4 efficiencies. Of the two BIC, one meets the efficiencies required at TSL 3. However, the two models have identical dimensions and share many components. Given the product similarities and low volume of sales, DOE expects the manufacturer would likely discontinue the non-compliant model. None of the three C–13A models meet the TSL 4 efficiencies. To meet the required efficiencies for their FCC models, DOE expects the manufacturer would likely need to incorporate incrementally more efficient compressors, along with other design options. DOE expects these updates to be relatively straight forward component swaps. Some product conversion costs would be necessary for sourcing, qualifying, and testing more efficient components. To meet the efficiencies required for their C–13A models, DOE expects the manufacturer would likely need to implement variable-speed compressors, along with other design options. Implementing variable-speed compressors could require more advanced controls and electronics and new test stations. DOE estimated conversion costs for this small manufacturer by using product platform estimates to scale-down the industry conversion costs. DOE estimates that the small would incur minimal capital conversion costs and product conversion costs of approximately $1.37 million related to sourcing and testing more efficient components and variable-speed compressors to meet proposed amended standards. Based on subscription-based market research reports, the small business has an annual revenue of approximately $85 million. The total conversion costs of $1.37 are approximately 0.3 percent of company revenue over the 5-year conversion period.

Based on a review of publicly available information, the other small business primarily sources their MREF products from Asian-based OEMs. However, DOE has tentatively determined that they make some MREF products in-house at a domestic manufacturing facility. DOE identified one FCC model certified in CCD. To meet the required efficiencies, DOE expects the manufacturer would likely need to incorporate incrementally more efficient compressors, along with other design options. As previously discussed, DOE expects these updates to be relatively straight forward component swaps. DOE estimated conversion costs for this small manufacturer by using product platform estimates to scale-down the industry conversion costs. DOE estimates that the small manufacturer would incur minimal capital conversion costs and approximately $420,000 in product conversion costs related to sourcing and testing more efficient components to meet proposed amended standards. Based on subscription-based market research reports, the small business has an annual revenue of approximately $200 million. The total conversion costs of approximately $420,000 are less than 1 percent of the estimated company revenue over the 5-year conversion period.

DOE seeks comments, information, and data on the number of small businesses in the industry, the names of those small businesses, and their market shares by product class. DOE also requests comment on the potential impacts of the proposed standards on small 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 4. In reviewing alternatives to the proposed rule, DOE examined energy conservation standards set at lower efficiency levels. While TSL 1, TSL 2, and TSL 3 would reduce the impacts on small business manufacturers, it would come at the expense of a reduction in energy savings. TSL 1 achieves 69 percent lower energy savings compared to the energy savings at TSL 4. TSL 2 achieves 37 percent lower energy savings compared to the energy savings at TSL 4. TSL 3 achieves 31 percent lower energy savings compared to the energy savings at TSL 4.

Based on the presented discussion, establishing standards at TSL 4 balances the benefits of the energy savings at TSL 4 with the potential burdens placed on MREF 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. EPCA provides that a manufacturer whose annual gross revenue from all of its operations does not exceed $8 million may apply for an exemption from all or part of an energy conservation standard for a period not longer than 24 months after the effective date of a final rule establishing the standard. (42 U.S.C. 6295(t)) Additionally, 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

Manufacturers of miscellaneous refrigeration products 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 miscellaneous refrigeration products, 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 miscellaneous refrigeration products. (*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 miscellaneous refrigeration products 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. (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. Pub. L. 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.*

Although this proposed rule does not contain a Federal intergovernmental mandate, it may require expenditures of $100 million or more in any one year by the private sector. Such expenditures may include: (1) investment in research and development and in capital expenditures by miscellaneous refrigeration product manufacturers in the years between the final rule and the compliance date for the new standards and (2) incremental additional expenditures by consumers to purchase higher-efficiency miscellaneous refrigeration products, starting at the compliance date for the applicable standard.

Section 202 of UMRA authorizes a Federal agency to respond to the content requirements of UMRA in any other statement or analysis that accompanies the proposed rule. (2 U.S.C. 1532(c)) The content requirements of section 202(b) of UMRA relevant to a private sector mandate substantially overlap the economic analysis requirements that apply under section 325(o) of EPCA and Executive Order 12866. The **SUPPLEMENTARY INFORMATION** section of this NOPR and the TSD for this proposed rule respond to those requirements.

Under section 205 of UMRA, the Department is obligated to identify and consider a reasonable number of regulatory alternatives before promulgating a rule for which a written statement under section 202 is required. (2 U.S.C. 1535(a)) DOE is required to select from those alternatives the most cost-effective and least burdensome alternative that achieves the objectives of the proposed rule unless DOE publishes an explanation for doing otherwise, or the selection of such an alternative is inconsistent with law. As required by 42 U.S.C. 6295(m) this proposed rule would establish amended energy conservation standards for miscellaneous refrigeration products that are designed to achieve the maximum improvement in energy efficiency that DOE has determined to be both technologically feasible and economically justified, as required by 6295(o)(2)(A) and 6295(o)(3)(B). A full discussion of the alternatives considered by DOE is presented in chapter 17 of the TSD for this proposed rule.

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 miscellaneous refrigeration products, 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.[76] 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.[77]

VII. Public Participation

A. Attendance at the Public Meeting Webinar

The time and date of the webinar meeting are listed in the **DATES** section at the beginning of this document. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website at *www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=39.* 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 plans to present a prepared general statement may request that copies of his or her statement be made available at the public meeting. Such persons may submit requests, along with an advance electronic copy of their statement in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format, to the appropriate address

[76] 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 August 30, 2022).

[77] The report is available at *www.nationalacademies.org/our-work/review-of-methods-for-setting-building-and-equipment-performance-standards* (Last accessed September 22, 2022)

shown in the **ADDRESSES** section at the beginning of this document. The request and advance copy of statements must be received at least one week before the public meeting and are to be emailed. Please include a telephone number to enable DOE staff to make follow-up contact, if needed.

C. Conduct of the Public Meeting

DOE will designate a DOE official to preside at the 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 public meeting. There shall not be discussion of proprietary information, costs or prices, market share, or other commercial matters regulated by U.S. antitrust laws. After the public meeting, interested parties may submit further comments on the proceedings, as well as on any aspect of the rulemaking, until the end of the comment period.

The public meeting will be conducted in an informal, conference style. DOE will present 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 allow, 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 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 previous procedures that may be needed for the proper conduct of the public meeting.

A transcript of the public meeting will be included in the docket, which can be viewed as described in the *Docket* section at the beginning of this document and will be accessible on the DOE website. 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 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 its proposal to amended refrigerator and freezer definitions to clarify that products that would otherwise be considered a refrigerator or a freezer that also include a cooler compartment would be considered a refrigerator or a freezer, unless a miscellaneous refrigeration product energy conservation standard is applicable for the product.

(2) DOE invites comment from the public regarding the competitive impacts that are likely to result from this proposed rule.

(3) DOE requests comments on its proposal to consolidate the presentation of maximum allowable energy use for products of classes that may or may not have an automatic icemaker.

(4) DOE requests comment on its proposal to establish energy conservation standards for combination cooler 5–BI using the analysis for combination class 3A as proxy for setting the standard level, based on a baseline efficiency equal to 6.08AV + 218 +28*I kWh/yr, where I is equal to 0 if the model has no automatic icemaker and equal to 1 if it does.

(5) DOE seeks further comment on any of the technologies screened out in this NOPR analysis as they were determined to not meet the screening criteria (*i.e.,* practicable to manufacture, install, and service and do not result in adverse impacts on consumer utility, product availability, health, safety, or use of unique-pathway proprietary technologies). DOE also seeks comment on those technologies retained for further consideration in the engineering analysis, based on the determination that they are technologically feasible and also meet the other screening criteria.

(6) DOE requests any further input from commenters regarding the approach for design option selection and implementation for a given model, beyond the information DOE has already considered.

(7) DOE seeks comment on the range of VSC nominal efficiencies and the relative overall efficiency gains offered by VSCs when operating at reduced compressor speeds along with reduced fan speeds in MREF products.

(8) In interviews, manufacturers noted that the majority of MREFs—namely freestanding compact coolers—are manufactured in Asia and rebranded by home appliance manufacturers. Manufacturers had few concerns about manufacturing constraints below the max-tech level and the implementation of VIPs. However, at max-tech, some manufacturers expressed technical uncertainty about industry's ability to meet the efficiencies required as few OEMs offer products at max-tech today. For example, DOE is not aware of any OEMs that currently offer freestanding compact coolers that meet TSL 5 efficiencies. DOE's shipments analysis estimates that except for built-in compact coolers, which only accounts for 4 percent of MREF shipments, no shipments of other product classes meet the max-tech efficiencies.

(9) DOE seeks comment on whether manufacturers expect manufacturing capacity constraints would limit product availability to consumers in the timeframe of the amended standard compliance date (2029).

(10) DOE requests information regarding the impact of cumulative regulatory burden on manufacturers of MREFs associated with multiple DOE standards or product-specific regulatory actions of other Federal agencies.

(11) DOE requests comment on the assumption used in developing the dealer/retailer markups and welcomes any feedback on the overall markup in the wholesaler channel.

(12) DOE requests comment on its methodology to develop market share distributions by adjusted volume in the compliance year for each product class with two representative volumes, as well as data to further inform these distributions.

(13) DOE requests comment and data on its price learning methodology used to project MREF prices in the future.

(14) DOE requests comment on its methodology to develop market share distributions by efficiency level for each product class for the no-new-standards case in the compliance year, as well as data to further inform these distributions.

(15) DOE requests comment and data on the assumptions and methodology used to calculate MREF survival probabilities.

(16) DOE requests comment and data on its efficiency distribution assumptions and projection into future years. Specifically, DOE is requesting comment and data on the efficiency distribution of non-AHAM members, to more accurately derive the efficiency distribution for the whole MREF market.

(17) DOE requests comment on the overall methodology and results of the LCC and PBP analyses.

(18) DOE requests comment on the overall methodology and results of the shipments analysis. More specifically, DOE seeks comment and data related to the total MREF shipments, market saturation, MREF shipments by product class, and non-AHAM-member shipments.

(19) DOE requests comment on the assumption that the current efficiency distribution would remain fixed over the analysis period, and data to inform an efficiency trend by product class or overall for the MREF market.

(20) DOE requests comment on the overall methodology and results of the consumer subgroup analysis.

(21) DOE welcomes comments on how to more fully assess the potential impact of energy conservation standards on consumer choice and how to quantify this impact in its regulatory analysis in future rulemakings.

Additionally, DOE welcomes comments on other issues 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 430

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Imports, Intergovernmental relations, Small businesses.

Signing Authority

This document of the Department of Energy was signed on March 10, 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 March 13, 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 430 of chapter II, subchapter D, of title 10 of the Code of Federal Regulations, as set forth below:

PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

■ 1. The authority citation for part 430 continues to read as follows:

Authority: 42 U.S.C. 6291–6309; 28 U.S.C. 2461 note.

■ 2. Section 430.2 is amended by revising the definitions of ''Freezer'' and ''Refrigerator'' to read as follows:

§ 430.2 Definitions.

* * * * *

Freezer means a cabinet, used with one or more doors, that has a source of refrigeration that requires single-phase, alternating current electric energy input only and consists of one or more compartments where at least one of the compartments is capable of maintaining compartment temperatures of 0 °F (−17.8 °C) or below as determined according to the provisions in § 429.14(d)(2) of this chapter. It does not include any refrigerated cabinet that consists solely of an automatic ice maker and an ice storage bin arranged so that operation of the automatic icemaker fills the bin to its capacity. However, the term does not include:

(1) Any product that does not include a compressor and condenser unit as an integral part of the cabinet assembly; or

(2) Any miscellaneous refrigeration product that must comply with an applicable miscellaneous refrigeration product energy conservation standard.

* * * * *

Refrigerator means a cabinet, used with one or more doors, that has a source of refrigeration that requires single-phase, alternating current electric energy input only and consists of one or more compartments where at least one of the compartments is capable of maintaining compartment temperatures above 32 °F (0 °C) and below 39 °F (3.9 °C) as determined according to § 429.14(d)(2) of this chapter. A refrigerator may include a compartment capable of maintaining compartment temperatures below 32 °F (0 °C), but does not provide a separate low temperature compartment capable of maintaining compartment temperatures below 8 °F (−13.3 °C) as determined according to § 429.14(d)(2). However, the term does not include:

(1) Any product that does not include a compressor and condenser unit as an integral part of the cabinet assembly;

(2) A cooler; or

(3) Any miscellaneous refrigeration product that must comply with an applicable miscellaneous refrigeration product energy conservation standard.

* * * * *

■ 3. Appendix A to subpart B of part 430 is amended by:

■ a. Revising section 5.3(a)(ii); and

■ b. Adding section 5.4.

The revision and addition read as follows.

Appendix A to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Refrigerators, Refrigerator-Freezers, and Miscellaneous Refrigeration Products

* * * * *

5.3 * * *

(a) * * *

(ii) For miscellaneous refrigeration products: To demonstrate compliance with the energy conservation standards at 10 CFR 430.32(aa) applicable to products manufactured on or after October 28, 2019, but before the compliance date of any amended standards published after January 1, 2022, IET, expressed in kilowatt-hours per cycle, equals 0.23 for a product with one or more automatic icemakers and otherwise equals 0 (zero). To demonstrate compliance with any amended standards published after January 1, 2022, IET, expressed in kilowatt-hours per cycle, is as defined section 5.9.2.1 of HRF–1–2019.

* * * * *

5.4 Test Cycle Energy Calculations for Cooler-Freezers

For cooler-freezers, determine the average per-cycle energy consumption consistent with section 5.9.3 of HRF–1–2019. If both compartments are at or colder than their standardized temperatures for both tests, use the equation in section 5.9.3.1. Otherwise, use the approach and equations in section 5.9.3.2, where applicable, the ''k'' value shall be 0.0.

■ 4. Appendix B to subpart B of part 430 is amended by:

■ a. Adding new paragraph (c) in section 5.2;

■ b. Adding new paragraph (d) in section 5.3; and

■ c. Adding section 5.4.

The additions read as follows.

Appendix B to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Freezers

* * * * *

5.2 * * *

(c) When testing freezers with a cooler compartment, refer to section 5.2 of appendix A.

* * * * *

5.3 * * *

(d) Freezers with a cooler compartment: the applicable ''K'' value in section 5.8.2 of HRF–1–2019 shall be equal to either 0.7 or 0.85 as determined by the product's freezer configuration.

5.4 Test Cycle Energy Calculations for Freezer With a Cooler Compartment

Refer to section 5.4 of appendix A.

* * * * *

■ 5. Amend § 430.32 by revising paragraph (aa) to read as follows:

§ 430.32 Energy and water conservation standards and their compliance dates.

* * * * *

(aa) *Miscellaneous refrigeration products.* The energy standards as determined by the equations of the following table(s) shall be rounded off to the nearest kWh per year. If the equation calculation is halfway between the nearest two kWh per year values, the standard shall be rounded up to the higher of these values.

(1) The following standards remain in effect from October 28, 2019 until [*date 5 years after the publication of the final rule*].

Product class	AEU (kWh/yr)
1. Freestanding compact	7.88AV + 155.8
2. Freestanding	7.88AV + 155.8
3. Built-in compact	7.88AV + 155.8
4. Built-in	7.88AV + 155.8

AV = Total adjusted volume, expressed in ft3, as determined in appendix A to subpart B of 10 CFR part 430.

The following standards apply to products manufacturer starting on [*date 5 years after the publication of the final rule*].

Product class	AEU (kWh/yr)
1. Freestanding compact	5.52AV + 109.1
2. Freestanding	5.52AV + 109.1
3. Built-in compact	5.52AV + 109.1
4. Built-in	6.30AV + 124.6

AV = Total adjusted volume, expressed in ft3, as determined in appendix A to subpart B of 10 CFR part 430.

(2) The following standards remain in effect from October 28, 2019 until [*date 5 years after the publication of the final rule*].

Product class	AEU (kWh/yr)
C–3A. Cooler with all-refrigerator—automatic defrost	4.57AV + 130.4
C–3A–BI. Built-in cooler with all-refrigerator—automatic defrost	5.19AV + 147.8
C–9. Cooler with upright freezer with automatic defrost without an automatic icemaker	5.58AV + 147.7
C–9–BI. Built-in cooler with upright freezer with automatic defrost without an automatic icemaker	6.38AV + 168.8
C–9I. Cooler with upright freezer with automatic defrost with an automatic icemaker	5.58AV + 231.7
C–9I–BI. Built-in cooler with upright freezer with automatic defrost with an automatic icemaker	6.38AV + 252.8
C–13A. Compact cooler with all-refrigerator—automatic defrost	5.93AV + 193.7
C–13A–BI. Built-in compact cooler with all-refrigerator—automatic defrost	6.52AV + 213.1

AV = Total adjusted volume, expressed in ft3, as determined in appendix A to subpart B of 10 CFR part 430.

The following standards apply to products manufacturer starting on [*date 5 years after the publication of the final rule*].

Product class	AEU (kWh/yr)
C–3A. Cooler with all-refrigerator—automatic defrost	4.11AV + 117.4
C–3A–BI. Built-in cooler with all-refrigerator—automatic defrost	4.67AV + 133.0
C–5–BI. Built-in cooler with refrigerator-freezer with automatic defrost with bottom-mounted freezer	5.47AV + 196.2 + 28I
C–9. Cooler with upright freezer with automatic defrost without an automatic icemaker	5.58AV + 147.7 + 28I
C–9–BI. Built-in cooler with upright freezer with automatic defrost without an automatic icemaker	6.38AV + 168.8 + 28I
C–13A. Compact cooler with all-refrigerator—automatic defrost	4.74AV + 155.0
C–13A–BI. Built-in compact cooler with all-refrigerator—automatic defrost	5.22AV + 170.5

AV = Total adjusted volume, expressed in ft3, as determined in appendix A to subpart B of 10 CFR part 430. I = 1 for a product with an automatic icemaker and = 0 for a product without an automatic icemaker.

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