DEPARTMENT OF ENERGY

10 CFR Part 431

[EERE–2020–BT–STD–0014]

RIN 1904–AE68

Energy Conservation Program: Energy Conservation Standards for Refrigerated Bottled or Canned Beverage Vending Machines

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

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

SUMMARY: The Energy Policy and Conservation Act, as amended (EPCA), prescribes energy conservation standards for various consumer products and certain commercial and industrial equipment, including refrigerated bottled or canned beverage vending machines (BVMs). 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 BVMs, 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 July 24, 2023.

Meeting: DOE will hold a public meeting via webinar on Wednesday, June 7, 2023, from 1:00 p.m. to 4:00 p.m. See section VII, ''Public Participation,'' for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

Comments regarding the likely competitive impact of the proposed standard should be sent to the U.S. Department of Justice (DOJ) contact listed in the **ADDRESSES** section on or before June 26, 2023.

ADDRESSES: Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *www.regulations.gov* under docket number EERE–2020–BT–STD–0014. Follow the instructions for submitting comments. Alternatively, interested persons may submit comments, identified by docket number EERE–2020–BT–STD–0014, by any of the following methods:

Email: BVM2020STD0014@ee.doe.gov. Include the docket number number EERE–2020–BT–STD–0014 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-0014.* 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 DOJ Antitrust Division invites input from market participants and other interested persons with views on the likely competitive impact of the proposed standard. Interested persons may contact the Division at *energy.standards@usdoj.gov* on or before the date specified in the **DATES** section. Please indicate in the ''Subject'' line of your email the title and docket number of this proposed rulemaking.

FOR FURTHER INFORMATION CONTACT:

Mr. Bryan Berringer, 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. Telephone: (202) 586–0371. Email: *ApplianceStandardsQuestions@ee.doe.gov.*

Ms. Sarah Butler, U.S. Department of Energy, Office of the General Counsel, GC–33, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (202) 586–1777. Email: *Sarah.Butler@hq.doe.gov.*

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

SUPPLEMENTARY INFORMATION:

Table of Contents

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. These products include BVMs, the subject of this proposed rulemaking. (42 U.S.C. 6295(v)) [3]

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 3 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 NOPR including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m)(3)(B))

In accordance with these and other statutory provisions discussed in this document, DOE proposes amended energy conservation standards for BVMs. The proposed standards, which are expressed in maximum daily energy consumption as a function of refrigerated volume, if adopted, would apply to all BVMs listed in Table I.1 manufactured in, or imported into, the United States starting on the date 3 years after the publication of the final rule for this proposed rulemaking.

TABLE I.1—PROPOSED ENERGY CONSERVATION STANDARDS FOR BVMS

Equipment class	Maximum daily energy consumption (kilowatt hours per day)
Class A	0.029 × V * + 1.34.
Class B	0.029 × V * + 1.21.
Combination A	0.048 × V * + 1.50.
Combination B	0.052 × V * + 0.96.

* V is the representative value of refrigerated volume (ft^3) of the BVM model, as calculated pursuant to 10 CFR 429.52(a)(3).

[1] All references to EPCA in this document refer to the statute as amended through the Infrastructure Investment and Jobs Act, Public Law 117–58 (Nov. 15, 2021).

[2] For editorial reasons, upon codification in the U.S. Code, Part B was redesignated Part A.

[3] Because Congress included BVMs in Part A of Title III of EPCA, the consumer product provisions of Part A (rather than the industrial equipment provisions of Part A–1) apply to BVMs. DOE placed the regulatory requirements specific to BVMs in 10 CFR part 431, ''Energy Efficiency Program for Certain Commercial and Industrial Equipment'' as a matter of administrative convenience based on their type and will refer to BVMs as ''equipment'' throughout this document because of their placement in 10 CFR part 431. Despite the placement of BVMs in 10 CFR part 431, the relevant provisions of Title A of EPCA and 10 CFR part 430, which are applicable to all product types specified in Title A of EPCA, are applicable to BVMs. *See* 74 FR 44914, 44917 (Aug. 31, 2009) and 80 FR 45758, 45759 (Jul. 31, 2015). The regulatory provisions of 10 CFR 430.33 and 430.34 and subparts D and E of 10 CFR part 430 are applicable to BVMs.

A. Benefits and Costs to Consumers

Table I.2 presents DOE's evaluation of the economic impacts of the proposed standards on consumers of BVMs, as measured by the average life-cycle cost (LCC) savings and the simple payback period (PBP).[4] The PBP is less than the average lifetime of BVMs, which is estimated to be 13.4 years (see section IV.F of this document).

TABLE I.2—IMPACTS OF PROPOSED ENERGY CONSERVATION STANDARDS ON CONSUMERS OF REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINES

Equipment class	Average LCC savings * (2021$)	Simple payback period (years)
Class A	(5.52)	5.7
Class B	206.01	1.2
Combination A	190.03	1.4
Combination B	287.16	2.2

* The savings represent the average LCC for affected consumers.

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 to the industry from the base year through the end of the analysis period (2028–2057). Using a real discount rate of 8.5 percent, DOE estimates that the INPV for manufacturers of BVMs in the case without amended standards is $85.5 million in 2021$. Under the proposed standards, the change in INPV is estimated to range from a loss of 2.2 percent to a gain 0.6 percent, which is approximately −$1.9 million to $0.5 million. In order to bring equipment into compliance with amended standards, it is estimated that the industry would incur total conversion costs of $1.5 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 [5]

DOE's analyses indicate that the proposed energy conservation standards for BVMs would save a significant amount of energy. Relative to the case without amended standards, the lifetime energy savings for BVMs purchased in the 30-year period that begins in the anticipated year of compliance with the amended standards (2028–2057) amount to 0.09 quadrillion British thermal units (Btu or quads).[6] This represents a savings of 30 percent relative to the energy use of this equipment in the case without amended standards (referred to as the ''no-new-standards case'').

The cumulative net present value (NPV) of total consumer benefits of the proposed standards for BVMs ranges from $0.09 billion (at a 7-percent discount rate) to $0.25 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 BVMs purchased in 2028–2057.

In addition, the proposed standards for BVMs are projected to yield significant environmental benefits. DOE estimates that the proposed standards would result in cumulative emission reductions (over the same period as for energy savings) of 3.0 million metric tons (Mt) [7] of carbon dioxide (CO_2), 1.4 thousand tons of sulfur dioxide (SO_2), 4.7 thousand tons of nitrogen oxides (NO_X), 21 thousand tons of methane (CH_4), 0.03 thousand tons of nitrous oxide (N_2O), and 0.009 tons of mercury (Hg).[8]

DOE estimates the value of climate benefits from a reduction in greenhouse gases (GHGs) 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 GHGs (''SC–GHGs''). 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 climate benefits associated with the average SC–GHG at a 3-percent discount rate are estimated to be $0.14 billion. DOE does not have a single central SC–GHG point estimate and it emphasizes the importance and value of considering the benefits calculated using all four sets of SC–GHG estimates.

DOE estimated the monetary health benefits of SO_2 and NO_X emissions reductions using benefit per ton estimates from the scientific literature, as discussed in section IV.L of this document. DOE estimated the present value of the health benefits would be $0.10 billion using a 7-percent discount rate and $0.27 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 monetized benefits and costs expected to result from the proposed standards for BVMs. There are other important unquantified effects, including certain unquantified climate benefits, unquantified public health benefits from the reduction of toxic air pollutants and other emissions, unquantified energy security benefits, and distributional effects, among others. The monetization of climate and health benefits that have been quantified is explained in section IV.L of this document.

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

[5] All monetary values in this document are expressed in 2021 dollars.

[6] 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.

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

[8] DOE calculated emissions reductions relative to the no-new-standards case, which reflects key assumptions in the *Annual Energy Outlook 2022* (*AEO2022*). *AEO2022* 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 *AEO2022* assumptions that effect air pollutant emissions.

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

[10] DOE estimates the economic value of these emissions reductions resulting from the considered TSLs for the purpose of complying with the requirements of E.O. 12866.

TABLE I.3—SUMMARY OF MONETIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR REFRIGERATED BOTTLED OR CANNED BVMS

[TSL 4]

	Billion ($2021)
3% discount rate	
Consumer Operating Cost Savings	0.33
Climate Benefits *	0.14
Health Benefits **	0.27
Total Benefits †	0.75
Consumer Incremental Product Costs ‡	0.08
Net Benefits	0.66
7% discount rate	
Consumer Operating Cost Savings	0.14
Climate Benefits * (3% discount rate)	0.14
Health Benefits **	0.10
Total Benefits†	0.38
Consumer Incremental Product Costs‡	0.05
Net Benefits	0.33

Note: This table presents the costs and benefits associated with BVMs shipped in 2028–2057. These results include benefits to consumers which accrue after 2057 from the products shipped in 2028–2057.

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

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

† Total and net benefits include those consumer, climate, and health benefits that can be quantified and monetized. For presentation purposes, total and net benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate, but DOE does not have a single central SC–GHG point estimate. DOE emphasizes the importance and value of considering the benefits calculated using all four sets of SC–GHG estimates.

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

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 cost savings are domestic private U.S. consumer monetary savings that occur as a result of purchasing the covered equipment and are measured for the lifetime of BVMs shipped in 2028–2057. The benefits associated with reduced emissions achieved as a result of the proposed standards are also calculated based on the lifetime of BVMs shipped in 2028–2057. Total benefits for both the 3-percent and 7-percent cases are presented using the average GHG social costs with a 3-percent discount rate. Estimates of SC–GHG values are presented for all four discount rates in section V.B.6 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 NO_X and SO_2 emissions, and the 3-percent discount rate case for climate benefits from reduced GHG emissions, the estimated cost of the standards proposed in this rule is $5.8 million per year in increased equipment costs, while the estimated annual benefits are $16 million in reduced equipment operating costs, $8.5 million in climate benefits, and $12 million in health benefits. In this case. The net benefit would amount to $30 million per year.

Using a 3-percent discount rate for all benefits and costs, the estimated cost of the proposed standards is $4.9 million per year in increased equipment costs, while the estimated annual benefits are $20 million in reduced operating costs, $8.5 million in climate benefits, and $16 million in health benefits. In this case, the net benefit would amount to $39 million per year.

TABLE I.4—ANNUALIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR BEVERAGE VENDING MACHINES

[TSL 4]

	Million 2021$/year		
	Primary estimate	Low net benefits estimate	High net benefits estimate
3% discount rate			
Consumer Operating Cost Savings	20	19	20
Climate Benefits *	8.5	8.5	8.5
Health Benefits **	16	16	17
Total Benefits †	44	44	45
Consumer Incremental Product Costs ‡	4.9	5.2	4.9

[11] To convert the time-series of costs and benefits into annualized values, DOE calculated a present value in 2021, 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 2021. 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.

TABLE I.4—ANNUALIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR BEVERAGE VENDING MACHINES—Continued

[TSL 4]

	Million 2021$/year		
	Primary estimate	Low net benefits estimate	High net benefits estimate
Net Benefits	39	38	40
7% discount rate			
Consumer Operating Cost Savings	16	15	16
Climate Benefits* (3% discount rate)	8.5	8.5	8.5
Health Benefits**	12	12	12
Total Benefits†	36	35	36
Consumer Incremental Product Costs‡	5.8	6.0	5.7
Net Benefits	30	29	31

Note: This table presents the costs and benefits associated with BVMs shipped in 2028–2057. These results include benefits to consumers which accrue after 2057 from the products shipped in 2028–2057. 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 sections IV.F.1 and IV.H.3 of this document. Note that the Benefits and Costs may not sum to the Net Benefits due to rounding.

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

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

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

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

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

D. Conclusion

DOE has tentatively concluded that the proposed standards represent the maximum improvement in energy efficiency that is technologically feasible and economically justified, and would result in the significant conservation of energy. Specifically, with regards to technological feasibility, equipment achieving these standard levels is 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 BVMs is $5.8 million per year in increased equipment costs, while the estimated annual benefits are $16 million in reduced equipment operating costs, $8.5 million in climate benefits, and $12 million in health benefits. The net benefit amounts to $30 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 standards are projected to result in estimated national energy savings of 0.09 quad full-fuel-cycle (FFC), the equivalent of the primary annual energy use of 2.4 million homes. In addition, they are projected to reduce CO_2 emissions by 3.0 Mt. Based on these findings, DOE has initially determined the energy savings from the proposed standard levels are ''significant'' within the meaning of 42 U.S.C. 6295(o)(3)(B). A more detailed discussion of the basis for these tentative conclusions is contained in the remainder of this document and the accompanying technical support document (TSD).

DOE also considered more stringent energy efficiency levels (ELs) 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 BVMs.

A. Authority

EPCA authorizes DOE to regulate the energy efficiency of a number of

[12] 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).

consumer products and certain industrial equipment. (42 U.S.C. 6291–6317) Title III, Part B of EPCA established the Energy Conservation Program for Consumer Products Other Than Automobiles. These products include BVM equipment, the subject of this document. (42 U.S.C. 6295(v)) EPCA directed DOE to prescribe energy conservation standards for BVMs not later than 4 years after August 8, 2005. (42 U.S.C 6295(v)(1)) 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))

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 BVMs appear at title 10 of the Code of Federal Regulations (CFR) part 431, subpart Q, appendix B.

DOE must follow specific statutory criteria for prescribing new or amended standards for covered products, including BVMs. 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 42 U.S.C. 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 BVMs, 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 of Energy (''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 that 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 reviewed the operating modes available for BVM equipment and determined that this equipment does not have operating modes that meet the definition of standby mode or off mode, as established at 42 U.S.C. 6295(gg)(3). Specifically, BVM equipment is typically always providing at least one main function—refrigeration. (42 U.S.C. 6295(gg)(1)(A)) DOE recognizes that in a unique equipment design, the low power mode includes disabling the refrigeration system, while for other equipment the low power mode controls only elevate the thermostat set point. Because low power modes still include some amount of refrigeration for most equipment, DOE believes that such a mode does not constitute a ''standby mode,'' as defined by EPCA, for BVM equipment. Therefore, DOE believes that BVM equipment does not operate under standby and off mode conditions as defined in EPCA, and that the energy use of BVM equipment would be captured in any standard established for active mode energy use. This NOPR does not specifically address standby and off mode energy consumption for this equipment.

B. Background

1. Current Standards

In the final rule published on January 8, 2016, DOE prescribed the current energy conservation standards for BVM equipment manufactured on and after January 8, 2019 (''January 2016 Final Rule''). 81 FR 1028. These standards are set forth in DOE's regulations at 10 CFR 431.296(b) and are repeated in Table II.1.

TABLE II.1—FEDERAL ENERGY CONSERVATION STANDARDS FOR REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINES

Equipment class	Maximum daily energy consumption (kilowatt hours per day)
Class A	$0.052 \times V\dagger + 2.43$.
Class B	$0.052 \times V\dagger + 2.20$.
Combination A	$0.086 \times V\dagger + 2.66$.
Combination B	$0.111 \times V\dagger + 2.04$.

† ''V'' is the representative value of refrigerated volume (ft3) of the BVM model, as calculated pursuant to 10 CFR 429.52(a)(3).

2. History of Standards Rulemaking for BVMs

On June 10, 2020, DOE published a request for information (''June 2020 RFI'') that identified various issues on which DOE sought comment to inform its determination of whether the standards need to be amended. 85 FR 35394.

On April 26, 2022, DOE published a notice that announced the availability of the preliminary analysis (''April 2022 Preliminary Analysis'') it conducted for purposes of evaluating the need for amended energy conservation standards for BVM equipment. 87 FR 24469. In that notification, DOE sought comment on the analytical framework, models, and tools that DOE used to evaluate efficiency levels for BVM equipment, the results of preliminary analyses performed, and the potential energy conservation standard levels derived from these analyses, which DOE presented in the accompanying preliminary TSD (''April 2022 Preliminary TSD'').

On May 23, 2022, DOE held a public webinar in which it presented the methods and analysis in the April 2022 Preliminary Analysis and solicited public comment.[13]

DOE received comments in response to the April 2022 Preliminary Analysis from the interested parties listed in Table II.2.

TABLE II.2—APRIL 2022 PRELIMINARY ANALYSIS WRITTEN COMMENTS

Commenter(s)	Abbreviation	Comment No. in the docket	Commenter type
Appliance Standards Awareness Project, American Council for an Energy-Efficient Economy.	ASAP, ACEEE	15	Efficiency Organization.
National Automated Merchandising Association	NAMA	14	Trade Association.

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[14] To the extent that interested parties have provided written comments that are substantively consistent with any oral comments provided during the May 2022 public meeting, DOE cites the written comments throughout this document. Any oral comments provided during the webinar that are not substantively addressed by written comments are summarized and cited separately throughout this document.

C. Deviation from Process Rule

In accordance with section 3(a) of 10 CFR part 430, subpart C, appendix A (''Process Rule''), DOE notes that it is deviating from the provision in the Process Rule regarding the pre-NOPR and NOPR stages for an energy conservation standards rulemaking.

1. Framework Document

Section 6(a)(2) of the Process Rule states that if DOE determines it is appropriate to proceed with a rulemaking, the preliminary stages of a rulemaking to issue or amend an energy conservation standard that DOE will undertake will be a framework document and preliminary analysis, or an advance notice of proposed rulemaking. While DOE published a preliminary analysis for this rulemaking (*see* 87 FR 24469), DOE did not publish a framework document in conjunction with the preliminary analysis. DOE notes, however, that chapter 2 of the preliminary technical support document that accompanied the preliminary analysis—entitled *Analytical Framework, Comments from Interested Parties, and DOE Responses*—describes the general analytical framework that DOE uses in evaluating and developing potential amended energy conservation standards.[15] As such, publication of a separate Framework Document would be largely redundant of previously published documents.

2. Public Comment Period

Section 6(f)(2) of the Process Rule specifies that the length of the public

[13] See *www.regulations.gov/document/EERE-2020-BT-STD-0014-0013* for a PDF version of the transcript.

[14] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to develop energy conservation standards for BVMs. (Docket No. EERE–2020–BT–STD–0014, which is maintained at *www.regulations.gov*). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

[15] The preliminary technical support document is available at *www.regulations.gov/document/EERE-2020-BT-STD-0014-0007*.

comment period for a NOPR will be not less than 75 calendar days. For this NOPR, DOE has opted instead to provide a 60-day comment period. DOE is opting to deviate from the 75-day comment period because stakeholders have already been afforded multiple opportunities to provide comments on this proposed rulemaking. As noted previously, DOE requested comment on various issues pertaining to this standards proposed rulemaking in the June 2020 RFI and provided stakeholders with a 60-day comment period. 85 FR 35394. Additionally, DOE initially provided a 60-day comment period for stakeholders to provide input on the analyses presented in the April 2022 Preliminary TSD. 87 FR 24469. The analytical assumptions and approaches used for the analyses conducted for this NOPR are similar to those used for the preliminary analysis. Therefore, DOE believes a 60-day comment period is appropriate and will provide interested parties with a meaningful opportunity to comment on the proposed rule.

3. Amended Test Procedures

NAMA requested that DOE finish the test procedure rulemaking before the standards rulemaking process begins. (NAMA, No. 14 at p. 16).

Section 8(d)(1) of the Process Rule specifies that test procedure rulemakings establishing methodologies used to evaluate proposed energy conservation standards will be finalized prior to publication of a NOPR proposing new or amended energy conservation standards. Additionally, new test procedures and amended test procedures that impact measured energy use or efficiency will be finalized at least 180 days prior to the close of the comment period for (1) a NOPR proposing new or amended energy conservation standards or (2) a notice of proposed determinaton that standards do not need to be amended. In the BVM test procedure final rule issued on April 25, 2023 (April 2023 Test Procedure Final Rule), DOE amended the test procedures for BVMs.[16] DOE determined that the amendments adopted will not alter (*i.e.,* will not impact) the measured efficiency of BVMs. *Id.* As such, the requirement that the amended test procedure be finalized at least 180 days prior to the close of the comment period for this NOPR do not apply.

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. General Comments

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

NAMA requested that DOE pay considerable attention to the economic impacts of new energy regulations on an industry under pressure due to factors such as the COVID–19 pandemic and the switch from hydrofluorocarbons (HFCs) to lower global warming potential (GWP) chemicals. (NAMA, No. 14 at p. 3)

NAMA commented to ask that DOE return to in-person meetings, stating that while electronic meetings provide value, they present challenges to full dialogue on these important subjects. (NAMA, No. 14 at p. 3)

NAMA commented that DOE should not discount the time and resources needed to evaluate and respond to all proposed test procedures and energy conservation standards for multiple products proposed over a short period, as is currently the case. (NAMA, No. 14 at p. 16) It noted that when these rulemakings occur simultaneously, as they are now and have in the past, the cumulative burden increases substantially. *Id.*

NAMA commented that it requested an extension to the Cooperative Research and Development Agreement (CRADA) between the NAMA Foundation, DOE, and the Oak Ridge National Laboratory (ORNL) so that the remaining items revolving around energy efficiency gains can be studied, and asked that DOE wait until the CRADA is finished before pursuing a regulation. (NAMA, No. 14 at p. 9) NAMA also commented that in the preliminary analysis TSD, DOE recognizes the existence of the CRADA between NAMA, DOE, and ORNL; however, NAMA stated the status of this CRADA is not current or correct in the TSD. *Id.* NAMA stated that most of the activities of the 2019–2021 CRADA were directed toward reduction of the risk involved in a possible leak situation if it were ever to occur. *Id.* NAMA commented that ORNL did extensive testing on leak scenarios and proposed new methods to reduce the risk from such a leak in a public space. *Id.* NAMA stated that, in nearly all the scenarios tested by ORNL, this involved the use of additional fans to circulate air. *Id.* NAMA commented that the energy used by additional ventilation is not accounted for in the preliminary analysis TSD and that, according to the proposed DOE test procedure, BVM manufacturers would be penalized to use additional ventilation and thus to reduce the safety risk. *Id.*

DOE has evaluated potential improvements to the energy efficiency of BVMs to support this NOPR through testing, teardowns, manufacturer interviews, market review, and comments submitted by stakeholders. DOE welcomes any additional comments and supporting data, including any additional results of the CRADA, in response to this NOPR.

In the April 2023 Test Procedure Final Rule, DOE determined to amend the test procedure to include additional instructions for refrigerant leak mitigation controls.[17] DOE specified that for refrigerant leak mitigation controls that are independent from the refrigeration or vending performance of the BVM, such controls must be disconnected, disabled, or otherwise de-energized for the duration of testing. *Id.* For refrigerant leak mitigation controls that are integrated into the BVM cabinet such that they cannot be de-energized without disabling the refrigeration or vending functions of the BVM or modifying the circuitry, such controls must be placed in an external accessory standby mode, if available, or their lowest energy-consuming state. *Id.*

Section 2.5.1.1 of the preliminary analysis TSD states that DOE acknowledges the ongoing research at ORNL. DOE recognized that leak mitigation technologies are still under development and continues to request comment and data on the use of such technologies and how they may impact BVM energy use. *Id.* DOE acknowledged that ASHRAE 15–2019, ASHRAE 34–2019, and UL 541 specified limitations on placing beverage vending machines using propane refrigerant in hallways or corridors and that these industry standards are often adopted as part of local codes. *Id.* DOE noted that, since the initial publication of the standards, addenda [18] to ASHRAE 15 and 34 have been published to remove the limitations on placing beverage vending machines using propane in hallways or

[16] See *www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=29.*

[17] See *www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=29.*

[18] ASHRAE 15–2019 Addendum C, published August 2020, and ASHRAE 34–2019 Addendum F, published December 2019, specifically address this issue and can be accessed at *www.techstreet.com/ashrae/standards/ashrae15-2019-packaged-w-34-2019?product_id=2046531.*

corridors. *Id.* These addenda specify a maximum charge limit based on the lower flammability limit of a refrigerant. *Id.* For BVM equipment using propane, the maximum charge limit permitted under the addenda is 114 grams. *Id.* DOE determined in the preliminary analysis TSD that this charge limit would allow BVM units in all equipment classes and available sizes to transition to propane without restricting installation locations of BVM units for end users. *Id.* Similarly, DOE states that it has already observed in the market and tested BVM units utilizing flammable refrigerants, specifically R–290. *Id.* In this NOPR, DOE has tentatively determined, based on manufacturer interviews, test data, and teardown data, that BVM units in all equipment classes and available sizes can use a R–290 charge of 114 grams or less. DOE has not observed any refrigeration leak mitigation controls that consume additional energy on BVMs using flammable refrigerants and, based on interviews conducted in support of this NOPR, refrigeration leak mitigation controls on BVMs using R–290 are not required because all BVMs use less than 114 grams of R–290. See chapter 5 of the NOPR TSD for additional discussion.

B. Scope of Coverage

This NOPR covers equipment that meet the definition of a refrigerated bottled or canned beverage vending machine, as codified at 10 CFR 431.292.

A ''refrigerated bottled or canned beverage vending machine'' is defined as a commercial refrigerator (as defined in 10 CFR 431.62) that cools bottled or canned beverages and dispenses the bottled or canned beverages on payment. 10 CFR 431.292.

See section IV.A.1 of this document for discussion of the equipment classes analyzed in this NOPR.

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 BVM equipment are expressed in terms of maximum daily energy consumption as a function of the refrigerated volume of the equipment; see 10 CFR 431.296(b).

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 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 BVM equipment, particularly the designs DOE considered, those it screened out, and those that are the basis for the standards considered in this rulemaking. For further details on the screening analysis for this rulemaking, see chapter 4 of the NOPR TSD.

2. Maximum Technologically Feasible Levels

When DOE proposes to adopt 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 BVM equipment 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.b of this document 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 the application of the TSL to BVMs purchased in the 30-year period that begins in the year of compliance with the proposed standards (2028–2057).[19] The savings are measured over the entire lifetime of BVMs 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 BVMs. 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.[20] 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.1 of this document.

NAMA commented that DOE overestimated energy savings over the 30 year analysis period. (NAMA, No. 14 at p. 14) DOE clarifies that the energy savings referenced are FFC energy savings, where the energy usage calculated by NAMA appears to be site energy usage. DOE also clarifies that energy savings are based on 30 years of shipments, but BVMs shipped in year

[19] 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.

[20] 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).

30 can continue to save energy until they are retired from service.

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.[21] 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, 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).

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 proposed 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 manufacturer employment and manufacturing capacity, as well as the potential for standards to result in plant closures and loss of capital investment. Finally, DOE takes into account cumulative impacts of various DOE regulations and other regulatory requirements on manufacturers.

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

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

EPCA requires DOE to consider the savings in operating costs throughout the estimated average life of the covered 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)) DOE conducts this comparison in its LCC and PBP analyses.

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 analyses, 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 analyses 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 of this document, DOE uses the NIA spreadsheet models to project national energy savings.

d. Lessening of Utility or Performance of Products

In establishing product classes and 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 DOJ provide its determination on this issue. DOE will publish and

[21] 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 13 December 2021 (86 FR 70892).

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 benefits in the form of reduced emissions of air pollutants and GHGs associated with energy production and use. DOE conducts an emissions analysis to estimate how potential standards may affect these emissions, as discussed in section IV.K of this document; the estimated emissions impacts are reported in section V.B.6 of this document. DOE also estimates the economic value of emissions reductions resulting from the considered TSLs, as discussed in section 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 PBP for consumers. These analyses include, but are not limited to, the 3-year PBP 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 of this document.

IV. Methodology and Discussion of Related Comments

This section addresses the analyses DOE has performed for this proposed rulemaking with regard to BVM equipment. Separate subsections address each component of DOE's analyses.

DOE used several analytical tools to estimate the impact of the standards proposed in this document. The first tool is a spreadsheet that calculates the LCC savings and PBP of potential amended or new energy conservation standards. The national impacts analysis uses a second spreadsheet set that provides shipments projections and calculates national energy savings and net present value of total consumer costs and savings expected to result from potential energy conservation standards. DOE uses the third spreadsheet tool, the Government Regulatory Impact Model (GRIM), to assess manufacturer impacts of potential standards. These three spreadsheet tools are available on the DOE website for this proposed rulemaking: *www.regulations.gov/docket/EERE-2020-BT-STD-0014.* For this NOPR analysis, the Energy Information Administration (EIA) *Annual Energy Outlook 2022* (*AEO2022*),[22] a widely known energy projection for the United States, was used for the life-cycle cost, emissions, and utility impact analyses, which was current for the analysis phase. However, near the time of publication of the NOPR, EIA released *AEO2023.* DOE plans to shift to *AEO2023* in the final rule analysis. A preliminary review of the electricity prices in *AEO2023* indicates lower electricity prices than *AEO2022* in the Reference case. Lower electricity prices could reduce the life-cycle savings and affect the related payback period calculations. DOE will update other variables and data sets in the final rule analysis in addition to use of *AEO2023,* as well as incorporate feedback from commenters.

A. Market and Technology Assessment

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

1. Equipment Classes

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

DOE currently separates BVM equipment into four equipment classes categorized by physical characteristics

[22] U.S. Department of Energy–Energy Information Administration. *Annual Energy Outlook 2022.* Washington, DC. Available at *https://www.eia.gov/outlooks/archive/aeo22//.*

that affect equipment utility and equipment efficiency: (1) whether 25 percent or more of the surface area on the front side of the BVM is transparent and (2) whether two or more compartments of the BVM are separated by a solid partition that may or may not share a product delivery chute, in which at least one compartment is designed to be refrigerated—as demonstrated by the presence of temperature controls—and at least one compartment is not (*i.e.,* a combination vending machine). The equipment classes are defined as follows:

Class A means a refrigerated bottled or canned beverage vending machine that is not a combination vending machine and in which 25 percent or more of the surface area on the front side of the beverage vending machine is transparent.

Class B means a refrigerated bottled or canned beverage vending machine that is not considered to be Class A and is not a combination vending machine.

Combination A means a combination vending machine where 25 percent or more of the surface area on the front side of the beverage vending machine is transparent.

Combination B means a combination vending machine that is not considered to be Combination A.

DOE currently sets forth energy conservation standards and relevant definitions for BVM equipment at 10 CFR 431.296 and 10 CFR 431.292, respectively, and the energy conservation standards are repeated in Table II.1.

a. Combination A

In the January 2016 Final Rule, DOE noted that the optional test protocol to determine the transparency of materials and the relative surface areas of transparent and non-transparent surfaces would be applicable to combination vending machines except that, the external surface areas surrounding the non-refrigerated compartment(s) would not be considered. 81 FR 1027, 1048. That is, all the surfaces that surround and enclose the compartment designed to be refrigerated (as demonstrated by the presence of temperature controls) as well as any surfaces that do not enclose any product-containing compartments (*e.g.,* surfaces surrounding any mechanical equipment or containing the product selection and delivery apparatus) would be considered in the calculation of transparent and non-transparent surface area for a BVM, as shown in Figure IV.1. *Id.*

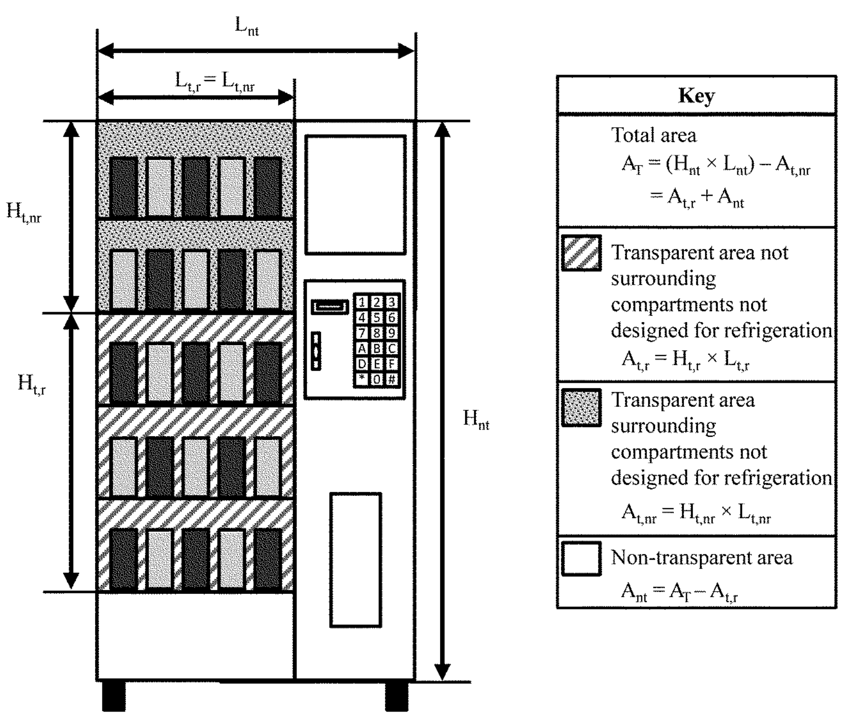

Figure IV.1 Determination of Transparent and Non-Transparent Area for a Combination Vending Machine with Products Arranged Horizontally. 81 FR 1027, 1049.

DOE notes that the January 2016 Final Rule and Figure IV.1 do not mention the solid partition that separates two or more compartments in a combination vending machine. The definition of combination vending machine at 10 CFR 431.292 does not limit the size or shape of the solid partition that might separate refrigerated and non-refrigerated subcompartments. Based on BVM teardowns conducted in support of this NOPR, DOE has initially determined that the solid partition projected to the front surface would constitue a small portion of the overall transparent surface area calculation. DOE has observed solid partitions with a projected front surface area of 0.5 inches of thickness and span the width of the internal compartment resulting in approximately 1.0% of the front surface area. Therefore, in this NOPR, DOE proposes to clarify that the solid partition would be considered in the calculation of transparent and non-transparent surface area for BVM equipment up to the centerline of the solid partition projected to the front surface for the surfaces that surround and enclose the compartment designed to be refrigerated (as demonstrated by the presence of temperature controls).

The definition of Combination A requires that ''25 percent or more of the surface area on the front side of the beverage vending machine is transparent.'' 10 CFR 431.292. Consistent with the January 2016 Final Rule, DOE proposes to revise the definition of Combination A to clarify the exclusion of the external surface areas surrounding the non-refrigerated compartment(s) in the calculation of surface areas of transparent and non-transparent surfaces:

Combination A means a combination vending machine where 25 percent or more of the surface area on the front side of the beverage vending machine that surrounds the refrigerated compartment(s) is transparent.

DOE requests comment on its proposal to revise the definition of Combination A.

2. Technology Options

In the preliminary market analysis and technology assessment, DOE identified 29 technology options that would be expected to improve the efficiency of BVM equipment, as measured by the DOE test procedure and shown in Table IV.1.

TABLE IV.1—TECHNOLOGY OPTIONS FOR REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINES IN THE APRIL 2022 PRELIMINARY TSD

Insulation:
Improved resistivity of insulation (insulation type).
Increased insulation thickness.
Vacuum insulated panels.
Improved Glass Packs:
Low-E coatings.
Inert gas fill.
Vacuum insulated glass.
Additional panes.
Frame design.
Compressor:
Improved compressor efficiency.
Variable speed compressors.
Linear compressors.
Evaporator:
Increased surface area.
Tube and fin enhancements (including microchannel designs).
Low pressure differential evaporator.
Condenser:
Increased surface area.
Tube and fin enhancements (including microchannel designs).
Microchannel heat exchanger.
Fans and Fan Motors:
Evaporator fan motors.
Evaporator fan blades.
Evaporator fan controls.
Condenser fan motors.
Condenser fan blades.
Other Technologies:
Lighting.
Anti-sweat heater controls.
Defrost systems.
Expansion valve improvements:
Alternative refrigerants.
Low power payment mechanisms.
Low power states.

DOE received several comments in response to the April 2022 Preliminary Analysis regarding the technology options.

a. Compressors

NAMA commented that, at the present time, variable speed and two-speed compressors are not available for the size range of compressors for most BVMs. (NAMA, No. 14 at p. 24)

NAMA commented that when moving from single speed compressors to variable speed compressors, in order to take full advantage of this level of energy efficiency, other components, such as metering devices (*i.e.,* expansion valves and capillary tubes), must be changed. (NAMA, No. 14 at p. 24) NAMA added that a control system will have to be added to monitor the system of the compressor, the cycle, the temperatures, and environmental conditions, and that these changes must be factored into the total cost. *Id.* NAMA commented that it is necessary for DOE to understand that the refrigeration cycle is only on for 20–25 percent of the time and that any savings must be allocated across the full set of DOE test procedure measurements. *Id.*

NAMA also commented that linear compressors are not available for BVMs and are many years away from concept design. In addition, NAMA commented that several manufacturers of linear compressors appear to have discontinued production. (NAMA, No. 14 at p. 24)

DOE has reviewed variable speed compressors available on the market and found that variable speed compressors are offered at the same cooling capacities as single speed compressors currently used in BVMs. All variable speed compressors observed had more than two speeds.

In this NOPR, DOE did not assume that additional components other than the variable speed compressor were required to reduce the energy use for the variable speed compressor design option. DOE is aware of refrigerant systems which use a capillary tube and a variable speed compressor which suggests that expansion valve changes are not necessary. Based on feedback received during manufacturer interviews, information collected during BVM teardowns, and market research, DOE has tentatively determined that control systems are already present in BVM equipment.

In the NOPR analysis, DOE considered the refrigeration cycle duration in the engineering analysis for the variable speed compressor design option. See chapter 5 of the NOPR TSD for additional details.

In the April 2022 Preliminary Analysis, DOE did not screen out linear compressors but did include linear compressors as a ''design option not directly analyzed.'' DOE included linear compressors as a technology option because compressor manufacturers had begun development on linear compressors for residential refrigerators. However, recent lawsuits and a lack of availability of linear compressors on the market have prevented further development of this technology for BVM equipment; therefore, DOE has tentatively determined that linear compressors meet the screening criterion of ''impacts on product utility or product availability.'' DOE has screened out linear compressors as a design option for improving the energy efficiency of BVM equipment. See section IV.B.1 of this document and chapter 4 of the NOPR TSD for additional details.

b. Alternative Refrigerants

NAMA commented that the changes necessary to adopt the lower GWP refrigerants are being made but have not been fully realized in all models of BVMs. (NAMA, No. 14 at p. 4) NAMA commented that DOE's statement that BVMs currently available on the market have already transitioned to R–290 refrigerant is incorrect. (NAMA, No. 14 at p. 16)

NAMA commented that the 114 grams of refrigerant that is allowed for the low GWP refrigerant is 36 grams less than what is allowed in a household or commercial refrigerator, which limits the size of the machine and restricts design options that require additional energy. (NAMA, No. 14 at p. 8)

DOE notes that the U.S. Environmental Protection Agency (EPA) proposed refrigerant restrictions pursuant to the American Innovation and Manufacturing Act (''AIM Act'') [23]

[23] Under subsection (i) of the AIM Act, entitled ''Technology Transitions,'' the EPA may by rule restrict the use of hydrofluorocarbons (HFCs) in sectors or subsectors where they are used. A person or entity may also petition EPA to promulgate such a rule. ''H.R.133—116th Congress (2019–2020): Consolidated Appropriations Act, 2021.'' *Congress.gov,* Library of Congress, 27 December

affecting BVM equipment in a NOPR published on December 15, 2022 (''December 2022 EPA NOPR''). 87 FR 76738. Specifically, EPA proposed prohibitions for new vending machines (EPA's term for this equipment) for the use of HFCs and blends containing HFCs that have a GWP of 150 or greater. 87 FR 76738, 76780. The proposal would prohibit manufacture or import of such vending machines starting January 1, 2025, and would ban sale, distribution, purchase, receive, or export of such vending machines starting January 1, 2026. 87 FR 76740. DOE considered the use of alternative refrigerants that are not prohibited for BVM equipment in the December 2022 EPA NOPR.

DOE notes that several manufactuerers currently rate BVM models to both ENERGY STAR [24] and DOE [25] with BVM equipment using R–290 and that manufacturers indicated in manufacturer interviews that the industry is planning to transition to R–290.

DOE is aware of the 114 gram charge limit for R–290 in BVM equipment located in a public corridor or lobby as specified in Addendum C to ANSI/ASHRAE Standard 15–2019, ''Safety Standard for Refrigeration Systems'' and UL 60335–2–89, ''Particular Requirements for Commercial Refrigerating Appliances and Ice-Makers with an Incorporated or Remote Refrigerant Unit or Motor-Compressor.'' Based on feedback received during manufacturer interviews, information collected during BVM teardowns, and market research, DOE has tentatively determined that the 114 gram charge limit does not restrict the size of the machine nor any technology options considered in this NOPR. DOE has tentatively determined that all BVM equipment can use less than 114 grams of R–290.

In response to the December 2022 EPA NOPR, this NOPR reflects the alternative refrigerant design changes made by manufacturers at the baseline levels for BVM equipment, which incorporate a refrigerant conversion to R–290 (*i.e.,* the most efficient refrigerant DOE is currently aware of on the market for BVM equipment), instead of as a design option as presented in the April 2022 Preliminary Analysis.

See section IV.C.1.a and chapter 5 of the NOPR TSD for additional details.

NAMA recommended that this be the last rulemaking to raise the issue of CO_2 as a refrigerant, and provided many details on the design differences and challenges in using CO_2 as a refrigerant. (NAMA, No. 14 at pp. 24–25)

While DOE mentioned CO_2 refrigerants in the April 2022 Preliminary TSD as background information on the January 2016 Final Rule, DOE did not consider CO_2 refrigerant as a technology option in the April 2022 Preliminary TSD or this NOPR.

c. Insulation

NAMA commented that the term ''extra insulation'' is vague, and manufacturers have been using ''extra'' insulation since the inception of BVMs. (NAMA, No. 14 at p. 21)

In the April 2022 Preliminary TSD, DOE provided context that ''extra insulation'' refers to an extra ¼ inch of insulation thickness. See chapter 5 of the April 2022 Preliminary TSD for additional details.

NAMA asserted that in low-volume manufacturing, with multiple variations of size, features, and designs, vacuum panels are not a feasible design option. (NAMA, No. 14 at p. 22) NAMA stated that vacuum panels often leak over time and return very little overall energy savings during the life of the product. *Id.* NAMA added that vacuum panels are very costly as individual parts, but even more so in tooling costs spread over very small volumes. *Id.*

Vacuum insulated panels (VIPs) may require cabinet redesign and additional tooling costs to properly incorporate VIPs in BVMs without leaks or damage to the panel. DOE has considered the investments required in additional tooling, equipment, and processes for any cabinet redesign in the engineering analysis (sunk cost per unit) and manufacturer impact analysis (capital conversion costs). See chapter 5 and 12 of the NOPR TSD for additional discussion on VIPs.

d. Fan Motors

NAMA commented that manufacturers changing to R–290 have already incorporated electronically commutated fan motors (ECMs) into their machines and many did this years ago. (NAMA, No. 14 at p. 21) NAMA added that, with the change to R–290, manufacturers of BVMs must utilize ADAC controls and components (sometimes called ''spark-proof'' motors). *Id.* NAMA further stated that current designs of permanent split capacitor motors (PSCs) are much more energy efficient than they were 5 or 10 years ago, and that NAMA approximates the energy use of an ECM to be higher than the value provided in the April 2022 Preliminary TSD. *Id.*

DOE considered the requirement for motors to be ''spark-proof'' for use with the R–290 refrigerant. DOE notes that, based on feedback received during manufacturer interviews, information collected during BVM teardowns, and market research, DOE has tentatively determined that manufacturers currently use shaded pole motors (SPMs), PSCs, and ECMs, although not all motor types are used in each BVM equipment class.

Based on feedback from commenters, market research, and additional testing, DOE has tentatively determined to update the fan motor efficiency assumptions in this NOPR. Consistent with commenters, DOE increased the assumed motor efficiency of SPMs and PSCs, and decreased the assumed motor efficiency of ECMs in this NOPR.

As noted in the April 2022 Preliminary TSD, DOE is also aware of an additional motor technology that is available for use in BVMs, permanent magnet synchronous (PMS) motors. PMS motor technology has shown the potential for motor efficiency improvement beyond ECMs, as indicated in a 2019 ORNL study comparing PMS motors and ECMs.[26] Due to the motor efficiency improvements PMS motors provide in comparison to ECMs, and based on DOE's updated fan motor efficiency assumptions (*i.e.,* ECM assumed efficiencies in this NOPR are less than the assumed PMS motor efficiencies), DOE has tentatively determined to include PMS motors as a design option for BVMs.

See chapter 5 of the NOPR TSD for additional details on fan motors.

e. Evaporators and Condensers

NAMA commented that true microchannel designs are prone to significant clogging and have been shown to exhibit pin-hole sized leaks, making them inadvisable with a flammable refrigerant. (NAMA, No. 14 at p. 23)

DOE acknowledges that microchannel condensers may experience clogging over the lifetime of a unit due to a lack of maintenance by the end user or other factors; however, DOE's BVM standards

2020, *www.congress.gov/bill/116thcongress/house-bill/133.*

[24] See *www.energystar.gov/productfinder/product/certified-vending-machines/results.*

[25] See *www.regulations.doe.gov/certification-data/CCMS-4-Refrigerated_Bottled_or_Canned_Beverage_Vending_Machines.html#q=Product_Group_s%3A%22Refrigerated%20Bottled%20or%20Canned%20Beverage%20Vending%20Machines%22.*

[26] Permanent Magnet Synchronous Motors for Commercial Refrigeration: Final Report, available at: *info.ornl.gov/sites/publications/Files/Pub115680.pdf.*

consider the performance of the unit as measured by the DOE BVM test procedure, which measures the performance of new BVMs. Additionally, tube and fin condensers may also experience clogging over the lifetime of a unit and require proper maintence of the condenser.

DOE notes that microchannel heat exchangers are currently used in a variety of applications, including mobile air-conditioning, commercial air-conditioning, residential air-conditioning, and commercial refrigeration equipment. Although DOE acknowledges that some microchannel condenser designs could have the potential to leak, DOE has observed the use of microchannel condensers with flammable refrigerants in similar applications (*e.g.,* automatic commercial ice makers). Additionally, pin-hole sized leaks are not unique to microchannel heat exchangers. Furthermore, DOE notes that the CRADA was established, in part, to mitigate leak risks and assess potential hazards, including flammability.[27]

f. Glass Packs

NAMA commented that the change from double pane to triple pane glass would require a significant increase in the overall structural design of the machine. (NAMA, No. 14 at p. 22) NAMA noted that the doors would have to increase in size, thickness, and weight, and that the wall structure and frame would have to be increased to accommodate the hanging weight. *Id.* NAMA added that the overall machine weight would increase, thereby increasing shipping weight and the corresponding transportation costs (and thus the carbon footprint of the machine). *Id.*

DOE observed both double pane and triple pane glass doors in BVM equipment and used the teardown analysis of units containing each door type to inform the NOPR analysis. DOE considered the additional cost related to structural changes when upgrading from double pane to triple pane glass doors. DOE did not receive any data which supported an increase in transporation costs when switching from double pane to triple pane glass doors. See chapter 5 of the NOPR TSD for additional detail.

g. Payment Mechanisms

ASAP and ACEEE encouraged DOE to include low-power coin and bill payment mechanisms as a design option in the engineering analysis, as BVMs are usually shipped with the payment mechanisms, and their energy consumption is captured in the test procedures. (ASAP & ACEEE, No. 15 at p. 1)

In the April 2023 Test Procedure Final Rule, DOE determined to maintain the current 0.20 kWh/day adder to account for the energy use of payment mechanisms.[28] The available information demonstrates that a wide (and growing) variety of payment systems are currently available on the market; the most common scenario is for the payment mechanism to be specified (and in some cases, provided) by the customer; and the customer may decide whether or not to have the payment mechanism installed by the BVM manufacturer at the time of sale. *Id.* Therefore, DOE did not consider low-power payment mechanisms as a design option in this NOPR. See chapter 5 of the NOPR TSD for additional details.

h. Low Power Modes

NAMA commented that it is unclear from the April 2022 Preliminary TSD exactly what DOE means by ''automatic lighting controls.'' (NAMA, No. 14 at pp. 19, 20) NAMA added that most of the machines sold today will go into a ''sleep'' mode after a period of inactivity, which is not the type of proximity control system used in display case products. *Id.* NAMA further commented that customers do not want a vending machine to go completely to ''sleep,'' because they want users to see the machine as fully functioning and not dark. *Id.* NAMA asserted that machines going completely ''dark'' is a change in utility of the machine and should be accounted for in a different category.

The ''automatic lighting control'' design option is based on the ''accessory low power mode'' section of the BVM test procedure which allows for 6 hours of operation in the accessory low power mode during the test (*i.e.,* the lowest energy-consuming lighting and control settings that constitute an accessory low power mode). Appendix B to subpart Q of 10 CFR part 431. Therefore, in the preliminary and NOPR analyses, DOE modeled 18 hours of light on time for the automatic lighting control design option and 6 hours of light off time.

''Accessory low power mode'' is defined as a state in which a beverage vending machine's lighting and/or other energy-using systems are in low power mode, but that is not a refrigeration low power mode. Functions that may constitute an accessory low power mode may include, for example, dimming or turning off lights, but does not include adjustment of the refrigeration system to elevate the temperature of the refrigerated compartment(s). *Id.*

DOE notes that there are currently 17 out of 53 Class A and Combination A models certified to DOE's Compliance Certification Database (CCD)[29] that use accessory low power mode. DOE also notes that manufacturers provide information on their low power mode operation in the unit's user manual for varying customer demands.

NAMA commented that many BVMs can be programmed into an ''energy saver'' mode based on inactivity or schedule. (NAMA, No. 14 at p. 20) NAMA added that consumers can set the machine to somewhat reduce the refrigeration cycle during nighttime if the location is truly ''shut down'' for many hours, but that DOE only allows a credit of 3 percent for this feature. *Id.* NAMA stated that mandating some form of automatic low power mode is different and will be beneficial only if the low power mode period is significantly longer, adding that if it is short, the energy savings will be offset by the additional energy required to bring the product back to the lower temperature. *Id.*

NAMA commented most current customers of BVMs do not want a low power mode that affects the holding temperature or lengthens the pulldown time, and that any change to this could have a direct effect on the utility and performance of the machine and should be avoided. (NAMA, No. 14 at p. 20)

DOE acknowledges that there is variability in customer location and activity and that some of the energy savings of the low power mode will be offset by the pulldown period to return to normal operation. As noted in the BVM test procedure NOPR published on August 11, 2014 (2014 BVM test procedure NOPR), DOE understands that refrigeration low power modes are extremely variable in terms of their control strategies and operation and, in addition, may require specific instructions from the manufacturer to precisely modify or adjust the control systems to accommodate the specific provisions of the DOE test procedure. 79 FR 46908, 46924–46925. As noted in BVM test procedure final rule published on July 31, 2015 (2015 BVM test procedure Final Rule), DOE's estimate of 3 percent energy savings due to the

[27] See *www.energy.gov/eere/buildings/articles/five-new-cooperative-research-agreements-invest-efficiency-performance-and.*

[28] See *www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=29.*

[29] See *www.regulations.doe.gov/certification-data/CCMS-4-Refrigerated_Bottled_or_Canned_Beverage_Vending_Machines.html#q=Product_Group_s%3A%22Refrigerated%20Bottled%20or%20Canned%20Beverage%20Vending%20Machines%22.* (Accessed February 9, 2023).

operation of low power modes is based on the data available and that DOE believes 3-percent is representative of the common types of refrigeration low power modes DOE has observed in the market place. 80 FR 45758, 45786. In the April 2023 Test Procedure Final Rule, DOE maintained the existing test procedure provisions and 3-percent energy credit for refrigeration low power mode.[30] In this NOPR, DOE has tentatively determined that 3-percent continues to be representative of the common types of refrigeration low power modes DOE has observed in the marketplace. See chapter 5 of the NOPR TSD for additional details.

DOE notes that there are currently 55 out of 107 BVM models certified to DOE's CCD [31] that use refrigeration low power mode. DOE also notes that manufacturers provide information on their low power mode operation in the unit's user manual for varying customer demands.

i. Additional Concerns

NAMA commented that several of the design options shown in the April 2022 Preliminary TSD (larger condensers or evaporators, more insulation, changes to type of glass) would require more space inside the machine, leading to a reduction in the overall capacity of the machine, which should be considered in the TSD. (NAMA, No. 14 at p. 11)

In this NOPR, DOE did not consider design options that expanded the size or footprint of BVM equipment (*e.g.,* larger condensers or evaporators, more insulation) because BVM equipment may be used in locations prioritizing smaller equipment footprints and an increase in cabinet sizes may adversely impact the availability of equipment at a given refrigerated volume. DOE assumed, based on feedback received during manufacturer interviews and from equipment teardowns, that the design options which changed the type of glass would not increase the door thickness but may require different frame materials or hinges, which DOE has considered as a cost adder to the design option in this NOPR. See chapter 5 of the NOPR TSD for additional details.

NAMA commented that several of the design options (*e.g.,* lower wattage refrigeration systems, vacuum panel insulation, different evaporators or condensers, and lower wattage fan motors) could potentially affect the overall performance of the machine, and therefore should be reviewed in the TSD not only for their energy efficiency but also the ability to maintain the critial design features and performance of these machines. (NAMA, No. 14 at p. 12)

In this NOPR, DOE did not consider design options that changed the measured performance as compared with existing BVM equipment. See chapter 5 of the NOPR TSD for additional details.

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 commercially viable, existing prototypes will not be considered further.

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

(3) *Impacts on product utility.* If a technology is determined to have a significant adverse impact on the utility of the product to subgroups of consumers, or 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) *Safety of technologies.* If it is determined that a technology would have significant adverse impacts on health or safety, it will not be considered further.

(5) *Unique-pathway proprietary technologies.* If a technology has proprietary protection and represents a unique pathway to achieving a given efficiency level, it will not be considered further, due to the potential for monopolistic concerns.

See sections 6(b)(3) and 7(b) of the Process Rule.

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.

DOE did not receive any comments in response to the April 2022 Preliminary Analysis specific to the screening analysis.

1. Screened Out Technologies

For BVM equipment, the screening criteria were applied to the technology options to either retain or eliminate each technology for consideration in the engineering analysis.

In the April 2022 Preliminary Analysis, DOE did not screen out linear compressors but did include linear compressors as a ''design option not directly analyzed.'' DOE included linear compressors as a technology option because compressor manufacturers had begun development on linear compressors for residential refrigerators. However, recent lawsuits and a lack of availability of linear compressors on the market have prevented further development of this technology for BVM equipment; therefore, DOE has tentatively determined that linear compressors meet the screening criterion of ''impacts on product utility or product availability.'' DOE has tentatively determined to screen out linear compressors as a design option for improving the energy efficiency of BVM equipment in this NOPR. See chapter 4 of the NOPR TSD for additional details.

2. Remaining Technologies

Through a review of each technology, DOE tentatively concluded 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 technology options in Table IV.2.

TABLE IV.2—RETAINED DESIGN OPTIONS FOR BVMS

Insulation	Condenser
Improved resistivity of insulation (insulation type)	Increased surface area.
Increased insulation thickness	Tube and fin enhancements (including microchannel designs).

[30] See *www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=29.*

[31] See *www.regulations.doe.gov/certification-data/CCMS-4-Refrigerated_Bottled_or_Canned_Beverage_Vending_Machines.html#q=Product_Group_s%3A%22Refrigerated%20Bottled%20or%20Canned%20Beverage%20Vending%20Machines%22.* (Accessed February 9, 2023).

TABLE IV.2—RETAINED DESIGN OPTIONS FOR BVMS—Continued

Vacuum insulated panels	Microchannel heat exchanger.
Improved Glass Packs	Fans and Fan Motors
Low-E coatings	Evaporator fan motors.
Inert gas fill	Evaporator fan blades.
Vacuum insulated glass	Evaporator fan controls.
Additional panes	Condenser fan motors.
Frame design	Condenser fan blades.
Compressor	Other Technologies
Improved compressor efficiency	Lighting.
Variable speed compressors	Anti-sweat heater controls.
	Defrost systems.
Evaporator	Expansion valve improvements
Increased surface area	Alternative refrigerants.
Tube and fin enhancements (including microchannel designs)	Low power payment mechanisms.
Low pressure differential evaporator	Low power states.

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

C. Engineering Analysis

The purpose of the engineering analysis is to establish the relationship between the efficiency and cost of BVM equipment. 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 equipment cost at each efficiency level (*i.e.,* the ''cost analysis''). In determining the performance of higher-efficiency equipment, DOE considers technologies and design option combinations not eliminated by the screening analysis. For each equipment class, DOE estimates the baseline cost, as well as the incremental cost for the equipment 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 equipment (*i.e.,* 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 equipment 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 in which the max-tech level exceeds the maximum efficiency level currently available on the market).

In this proposed rulemaking, DOE relies on a design option approach, supported with testing and reverse engineering multiple analysis units. DOE generally relied on test data and reverse engineering to inform a range of design options used to reduce energy use. The design options were incrementally added to the baseline configuration and continued through the ''max-tech'' configuration (*i.e.,* implementing the ''best available'' combination of available design options).

Consistent with the January 2016 Final Rule analysis (see chapter 5 of the January 2016 Final Rule TSD), DOE estimated the performance of design option combinations using an engineering analysis spreadsheet model. This model estimates the daily energy consumption of BVM equipment in kWh/day at various performance levels using a design option approach. The model calculates energy consumption at each performance level separately for each analysis configuration.

For Class A and Class B, DOE analyzed machines of different sizes to assess how energy use varies with size via energy testing and reverse engineering. In this NOPR, representative volumes were chosen for each equipment class, based on current market offerings: medium and large for Class A and Class B BVMs, and medium for Combination A and Combination B. These equipment classes and representative unit volumes are listed in Table IV.3.

TABLE IV.3—REPRESENTATIVE REFRIGERATED VOLUMES IN THE NOPR

Equipment class	Size	Representative volume (ft³)
Class A	Medium	26
	Large	35
Class B	Medium	22
	Large	31
Combination A	Medium	11
Combination B	Medium	10

See chapter 5 of the NOPR TSD for additional detail on the different units analyzed.

a. Baseline Energy Use

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

For this NOPR, DOE considered the current standards for BVM equipment when developing the baseline energy use for each analyzed equipment class. For higher efficiency levels, DOE assessed BVM efficiencies as a percent improvement relative to the baseline. This provides a consistent efficiency comparison across each equipment class. DOE considered the efficiency improvements associated with implementing available design options beyond the baseline to the max-tech efficiency level.

In response to the April 2022 Preliminary Analysis, NAMA commented that most of the analysis appears to have been performed prior to 2020, yet the industry has been in the midst of considerable change from 2019 to 2022. (NAMA, No. 14 at p. 3)

NAMA commented that current machines on the market today that use low GWP refrigerants and incorporate most of the design options shown in Table 2.3 of the April 2022 Preliminary Analysis should be used together with current costs, and that these should be the baseline machines. (NAMA, No. 14 at p. 6) NAMA added that DOE should acknowledge the costs already incurred by manufacturers in order to meet the goals stated by the Biden Administration to reduce global warming. *Id.*

DOE expects that NAMA is referring to the December 2022 EPA NOPR in its comment regarding the goals stated by the Biden Administration to reduce global warming. As recommended by stakeholders, DOE is considering the cost and impact of the December 2022 EPA NOPR on this NOPR. The proposed date of the proposed GWP limit on BVMs is 2 years earlier than the expected compliance date for any amended BVM standards associated with the proposals in this document. Hence, the proposed refrigerant prohibitions listed in the December 2022 EPA NOPR are assumed to be enacted for the purpose of DOE's analysis in support of this NOPR.

Refrigerants not prohibited from use in BVM equipment in the December 2022 EPA NOPR are presumed to be permitted for use in BVM equipment. As noted in section IV.A.2.b, several manufactuerers currently rate BVM models to both ENERGY STAR[32] and DOE[33] with BVM equipment using R–290, manufacturers indicated in manufacturer interviews that the industry is planning to transition to R–290, and DOE has tentatively determined that all BVM equipment can use less than 114 grams of R–290.

DOE expects that the use of R–290 generally will improve efficiency as compared with the refrigerants currently in use (*e.g.,* R–134a), which are proposed to be prohibited by the December 2022 EPA NOPR, because R–290 has higher refrigeration cycle efficiency than the current refrigerants. Thus, DOE expects that the December 2022 EPA NOPR will require redesign that will improve efficiency of BVM equipment. Hence, the baseline levels for BVM equipment in this NOPR reflect the design changes made by manufacturers in response to the December 2022 EPA NOPR, which incorporate refrigerant conversion to R–290. The expected efficiency improvement associated with this refrigerant change varies by class and is presented in Table IV.4.

DOE's analysis considers that these efficiency improvements, equipment costs, and manufacturer investments required to comply with the December 2022 EPA NOPR will be in effect prior to the time of compliance for the proposed amended DOE BVM standards for all BVM equipment classes and sizes. DOE updated its baseline equipment costs to reflect current costs based on feedback received during manufacturer interviews, information collected during BVM teardowns, and market research.

TABLE IV.4—PROPOSED DECEMBER 2022 EPA NOPR R–290 ENERGY USE BASELINE

Equipment class	Energy use reduction below DOE standard (%)
Class A	12.7
Class B	15.1
Combination A	19.6
Combination B	14.7

The expected efficiency improvement associated with this refrigerant change is based on R–290 single speed compressors currently available on the market suitable for BVM equipment. In this NOPR, DOE did not consider additional single speed compressor efficiency improvements beyond the baseline because DOE expects that the single speed compressors currently available on the market for refrigerants used to comply with the December 2022 EPA NOPR represent the maximum single speed compressor efficiency achievable for each respective equipment class.

NAMA commented that the improved evaporator coils design option seems to be indicating a high fin density and higher pitched coils, but any increase in fin density may increase the fan motor power required and energy

[32] See *www.energystar.gov/productfinder/product/certified-vending-machines/results.*

[33] See *www.regulations.doe.gov/certification-data/CCMS-4-Refrigerated_Bottled_or_Canned_Beverage_Vending_Machines.html#q=Product_Group_s%3A%22Refrigerated%20Bottled%20or%20Canned%20Beverage%20Vending%20Machines%22.*

consumption. (NAMA, No. 14 at p. 20) NAMA added that current designs are optimized based on cost versus energy efficiency, and that changes would increase capital costs. *Id.*

In the April 2022 Preliminary Analysis, DOE analyzed ''baseline'' and ''high efficiency'' evaporator and condenser design options, consistent with the January 2016 Final Rule. Based on stakeholder comments, interviews with manufacturers, and CoilDesigner simulation, DOE tentatively determined that the ''high efficiency'' evaporator and condenser design options are representative of current manufacturer designs. Therefore, DOE tentatively determined to analyze the ''high efficiency'' evaporator and condenser coil as ''baseline'' in this NOPR and remove the ''high efficiency'' evaporator and condenser design options in the NOPR. See chapter 5 of the NOPR TSD for additional details.

NAMA commented that according to the Process Rule, DOE should not pursue a rulemaking if there were less than 0.30 quad of savings over 30 years, as the last published Process Rule dictates. (NAMA, No. 14 at p. 7) NAMA added that it doesn't believe there will be greater than 5–10 percent improvement in energy baseline by 2028 to justify the rule. *Id.* NAMA stated that, including the fact that many of the improvements in the design options have already been incorporated several years ago, the actual improvements it projected to be seen are much less than 10 percent. *Id.*

DOE notes that on December 13, 2021, DOE published a Final Rule which revised the Process Rule NAMA is referring to in its comment,[34] and determinations of significance for energy savings are made on a case-by-case basis. 86 FR 70892, 70906. DOE discusses 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 in section V.C.1.

DOE requests comments on its proposal to use baseline levels for BVM equipment based upon the design changes made by manufacturers in response to the December 2022 EPA NOPR.

DOE further requests comment on its estimates of energy use reduction associated with the design changes made by manufacturers in response to the December 2022 EPA NOPR.

[34] See *www.regulations.gov/document/EERE-2021-BT-STD-0003-0075.*

b. Higher Efficiency Levels

As part of DOE's analysis, the maximum available efficiency level is the highest efficiency unit currently available on the market. DOE also defines a ''max-tech'' efficiency level to represent the maximum possible efficiency for a given equipment.

After conducting the screening analysis described in section IV.B of this document and chapter 4 of the NOPR TSD, DOE considered the remaining design options in the engineering analysis to achieve higher efficiency levels. See chapter 5 of the NOPR TSD for additional detail on the design options.

NAMA commented that although DOE estimates 25 percent energy savings for improved evaporator coils, their review of design options indicates that this is overstated by a factor of 10. (NAMA, No. 14 at p. 20)

DOE expects that NAMA is referring to the total energy use reduction below the baseline at a given efficiency level instead of the energy use reduction for each design option. However, as discussed in section IV.C.1.a of this document, DOE tentatively determined to analyze the ''high efficiency'' evaporator coil as ''baseline'' in this NOPR and remove the ''high efficiency'' evaporator design option in the NOPR.

NAMA commented that for moving from single speed compressors to variable speed compressors, the promised energy savings is more in the area of 5–15 percent (depending on the model), rather than the 49 percent estimated in the April 2022 Preliminary Analysis TSD. (NAMA, No. 14 at p. 24)

DOE expects that NAMA is referring to the total energy use reduction below the baseline at a given efficiency level instead of the energy use reduction for each design option. In this NOPR, DOE assumed an energy use reduction of 7–14% for variable speed compressors compared to single speed compressors, depending on the equipment class, which is consistent with NAMA's estimates. See chapter 5 of the NOPR TSD for additional details.

NAMA commented that DOE's estimate of a 43 percent improvement in energy efficiency with the switch from double pane to triple pane glass is much higher than NAMA's estimate of 12–15 percent improvement in energy efficiency. (NAMA, No. 14 at p. 22)

DOE expects that NAMA is referring to the total energy use reduction below the baseline at a given efficiency level instead of the energy use reduction for each design option. In this NOPR, DOE assumed an energy use reduction of 1–3% for triple pane glass pack compared to double pane glass pack, depending on the equipment class, which is lower than NAMA's estimates but is consistent with data collected from teardowns and DOE's modeling. See chapter 5 of the NOPR TSD for additional details.

NAMA commented that when moving from triple pane glass to vacuum insulated glass, the efficiency improvements are in the vicinity of 2–3 percent gain. (NAMA, No. 14 at p. 24)

In this NOPR, DOE assumed an energy use reduction of approximately 1% for vacuum insulated glass compared to triple pane glass pack, which is consistent with NAMA's estimates. See chapter 5 of the NOPR TSD for additional details.

NAMA commented that there is not sufficient space in a BVM to allow for the recommended change to insulation thickness. (NAMA, No. 14 at p. 21) NAMA stated that there is not sufficient space to allow for insulation to equate to a reduction of even 10 percent in energy, much less 31 percent, without impacting utility and performance. *Id.*

DOE expects that NAMA is referring to the total energy use reduction below the baseline at a given efficiency level instead of the energy use reduction for each design option. In this NOPR, DOE did not consider design options that expanded the size or footprint of BVM equipment (*e.g.,* more insulation) because BVM equipment may be used in locations prioritizing smaller equipment footprints and an increase in cabinet sizes may adversely impact the availability of equipment at a given refrigerated volume. See chapter 5 of the NOPR TSD for additional details.

NAMA commented that it believes the 0.15 quad savings at max-tech is an inflated value based on errors in the engineering analysis, and asserted that the savings would in fact be considerably lower and no longer significant enough for the changes in regulation to be justified. (NAMA, No. 14 at p. 7)

In this NOPR, DOE estimates a combined total of 0.138 quads of FFC energy savings over the analysis period at the max-tech efficiency levels for BVM equipment. DOE has considered feedback from stakeholders, manufacturer interviews, and current market data to update its engineering analysis in this NOPR. See section V for additional details.

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 equipment, and the availability and timeliness of purchasing the equipment on the market. The cost approaches are summarized as follows:

- *Physical teardowns:* Under this approach, DOE physically dismantles a commercially available equipment, component-by-component, to develop a detailed bill of materials for the equipment.
- *Catalog teardowns:* In lieu of physically deconstructing a equipment, 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 equipment.
- *Price surveys:* If neither a physical nor catalog teardown is feasible (*e.g.,* 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 teardowns and feedback received from manufacturers during interviews. See chapter 5 of the NOPR TSD for additional details.

DOE received several comments in response to the April 2022 Preliminary Analysis regarding the cost analysis.

NAMA believes that DOE should factor the unprecedented increase in inflation of basic constituents of the BVM machine and its manufacturing into the costs shown for design options and the economic analysis. (NAMA, No. 14 at p. 10)

DOE used current prices when estimating the baseline manufacturer production costs and design option costs. See chapter 5 of the NOPR TSD for additional details.

NAMA commented that the analyses in the April 2022 Preliminary TSD do not address the major changes necessary to the machines to utilize the lower GWP refrigerants (*e.g.,* R–290). (NAMA, No. 14 at p. 4) NAMA asserted that for low GWP, flammable A–3 refrigerants to be allowed for use in machines, redesign of the evaporator and condensor system and the use of new compressors and expansion valves would be necessary. *Id.* Additionally, NAMA noted that all switches, electrical components, motors (including robotic or vend motors), wiring, and connectors must be compliant with ''spark-proof'' connections to shield against the possibility of a leak of such refrigerant. *Id.* NAMA commented that neither this level of redesign nor the use of these expensive components was addressed in the April 2022 Preliminary TSD. *Id.*

NAMA commented that the incremental cost given in the DOE chart of $11.28 to switch from an R–134 compressor to an R–290 compressor is inaccurate considering that the compressor is only one of many components that must change if the refrigerant is changed to an A–3 refrigerant. (NAMA, No. 14 at pp. 5, 19) NAMA stated that the increase in the cost of the compressor by itself is more than $40, and from their sample of five manufacturers, the cost of the change from R–134 to R–290 is approximately $200 per machine rather than $11.28 when all the components that must change are factored in. *Id.*

As discussed in section IV.C.1.a of this document, DOE has analyzed R–290 as the baseline refrigerant for this NOPR, and as a result, DOE updated its baseline equipment costs to reflect current costs based on feedback received during manufacturer interviews, information collected during BVM teardowns, and market research, which includes the costs for component changes and additions related to R–290. DOE's analysis considers that these efficiency improvements, equipment costs, and manufacturer investments required to comply with the December 2022 EPA NOPR will be in effect prior to the time of compliance for the proposed amended DOE BVM standards for all BVM equipment classes and sizes. See chapter 5 of the NOPR TSD for additional details.

NAMA commented that for moving from single speed compressors to variable speed compressors, the current data shows cost increases in other product categories much higher than the $103.12 shown, and that early cost estimates are more than $200 per machine. (NAMA, No. 14 at p. 24)

NAMA commented that DOE's estimate of $16.72 per machine for improved evaporator coils is significantly below NAMA's estimates of the parts alone, and that NAMA's initial estimate is double this amount and perhaps more when considering capital costs, design, and recertification. (NAMA, No. 14 at p. 20)

NAMA commented that DOE's estimated cost of $32.36 for the extra insulation likely does not factor in the cost of redesigning new tooling to encompass additional insulation. (NAMA, No. 14 at p. 21)

NAMA commented that the cost estimate of $15.31 for moving from tube and fin to microchannels is not realistic and is not borne out by discussion with vendors, as this change would require a complete redesign of all parts of the vending machine refrigeration system and would need to include a large associated capital cost. (NAMA, No. 14 at p. 23)

NAMA commented that the cost estimates its industry has seen are three to four times the cost of glass mentioned in the April 2022 Preliminary TSD when moving from triple pane glass to vacuum insulated glass. (NAMA, No. 14 at p. 24)

NAMA commented that the cost estimate of $72.84 with the switch to multiple panes of glass is about half of the total cost when considering increased structural components at extremely high volumes. (NAMA, No. 14 at p. 22) NAMA stated that because of these factors, most manufacturers would not realize this energy efficiency improvement and would see much higher costs for little or no energy improvement. *Id.*

DOE notes that, as discussed in section IV.C.1.a of this document, DOE did not analyze evaporator improvements or extra insulation as design options.

DOE assumed, based on feedback received during manufacturer interviews and from equipment teardowns, that the design options which changed the type of glass may require different frame materials or hinges, which DOE has considered as a cost adder to these design options in this NOPR.

DOE updated its baseline and design option costs to reflect current costs based on feedback received during manufacturer interviews, information collected during BVM teardowns, stakeholder comments, and market research. See chapter 5 of the NOPR TSD for additional details.

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 filed by publicly traded manufacturers primarily engaged in equipment manufacturing and whose combined equipment range includes BVM equipment.

3. Cost-Efficiency Results

The results of the engineering analysis are reported as cost-efficiency data (or ''curves'') in the form of daily energy consumption (in kWh) versus MSP (in dollars). DOE developed six curves representing the four equipment classes. The methodology for developing the curves started with determining the energy consumption for baseline equipment and MPCs for this equipment. Above the baseline, design options were implemented until all available technologies were employed (*i.e.,* at a max-tech level). See chapter 5 of the NOPR TSD for additional detail on the engineering analysis and appendix 5B of the NOPR TSD for complete cost-efficiency results.

D. Markups Analysis

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

For BVMs, the main parties in the distribution chain are manufacturers, wholesalers, and the end users.

DOE developed baseline and incremental markups for each actor in the distribution chain. 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.[35]

DOE relied on economic data from the U.S. Census Bureau to estimate average baseline and incremental markups.

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

E. Energy Use Analysis

The purpose of the energy use analysis is to determine the annual energy consumption of BVMs at different efficiencies in representative U.S. commercial and industrial buildings, and to assess the energy savings potential of increased BVM efficiency. For the NOPR analysis, DOE selected seven efficiency levels (ELs) for each equipment class, each characterized as a percentage of rated daily energy consumption from the baseline, up to the max-tech efficiency levels defined for each class in the engineering analysis. Each level with the corresponding percentage of baseline rated energy consumption varies by equipment class and can be found in Chapter 7 of the NOPR TSD.

The energy use analysis then estimates the range of energy use of BVMs 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 operating costs that could result from adoption of amended or new standards.

The energy use analysis assessed the estimated annual energy consumption of a BVM installed in the field. DOE recognizes that a variety of factors may affect the energy use of a BVM, including ambient conditions, use and stocking profiles, and other factors. However, very limited data exist on field energy consumption of BVMs. DOE estimated that the daily energy consumption produced by the DOE test procedure is representative of the average daily energy consumption of a BVM in an indoor environment. DOE developed a methodology to account for the impact of ambient conditions on the average annual energy consumption. To model the annual energy consumption of each BVM unit, DOE separately estimated the energy use of BVMs located indoors and outdoors to account for the impact of ambient conditions on installed BVM energy use. Chapter 7 of the NOPR TSD provides details on DOE's energy use analysis for BVMs.

In response to the April 2022 Preliminary Analysis, NAMA commented that the energy used by additional ventilation to reduce the risk of a leak in a public space was not accounted for in the April 2022 Preliminary TSD. (NAMA, No. 14 at p. 9)

In response to the NAMA comment, DOE notes that the NAMA concern regarding additional ventilation needs is due to the presumed use of hydrocarbon refrigerants. DOE notes that the analysis assumes hydrocarbon refrigerants at all efficiency levels analyzed, including the baseline, and any building energy impact due to additional ventilation requirements in spaces surrounding BVMs is the same at all efficiency levels and does not impact the differential energy consumption between efficiency levels or the subsequent economic calculations.

NAMA commented that although DOE has asserted that coin and bill payment systems are typically included with BVMs as shipped, its survey has indicated that this is not uniform and is unique to certain manufacturers and customers. (NAMA, No. 14 at p. 12) NAMA also questioned whether the approximation of 0.2 kWh per day is accurate for the energy consumption of a payment mechanism, although it considers the present solution to be preferable to the significant amount of time it would take testing in laboratories to determine a more accurate approximation resulting in a difference of a fraction of a kWh per day. (NAMA, No. 14 at p. 13)

In the April 2023 Test Procedure Final Rule, DOE determined to maintain the current 0.20 kWh/day adder to account for the energy use of payment mechanisms.[36] The available information demonstrates that a wide (and growing) variety of payment systems are currently available on the market; the most common scenario is for the payment mechanism to be specified (and in some cases, provided) by the customer; and the customer may decide whether or not to have the payment mechanism installed by the BVM manufacturer at the time of sale. *Id.* Therefore, DOE did not consider low-power payment mechanisms as a design option in this NOPR. See chapter 5 of the NOPR TSD for additional details.

F. Life-Cycle Cost and Payback Period Analysis

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

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

[36] See *www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=29.*

• 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 BVMs 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 equipment.

For each considered efficiency level in each equipment class, DOE calculated the LCC and PBP for a nationally representative set of consumers. As stated previously, DOE developed consumer samples from the most recent industry reports. For each sample consumer, DOE determined the energy consumption for the BVM and the appropriate energy price. By developing a representative sample of consumers, the analysis captured the variability in energy consumption and energy prices associated with the use of BVMs.

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, refurbishment, and maintenance costs; equipment lifetimes; and discount rates. DOE created distributions of values for equipment lifetime, discount rates, and sales taxes, with probabilities attached to each value, to account for their uncertainty and variability.

The computer model DOE uses to calculate the LCC relies on a Monte Carlo simulation to incorporate uncertainty and variability into the analysis. The Monte Carlo simulations randomly sample input values from the probability distributions and BVM user samples. For this rulemaking, the Monte Carlo approach is implemented in MS Excel together with the Crystal Ball ™ add-on.[37] The model calculated the LCC for products at each efficiency level for 10,000 consumers 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, equipment efficiency is chosen based on its probability. If the chosen equipment efficiency is greater than or equal to the efficiency of the standard level under consideration, the LCC calculation reveals that a consumer is not impacted by the standard level. By accounting for consumers who already purchase more efficient equipment, DOE avoids overstating the potential benefits from increasing equipment efficiency.

DOE calculated the LCC and PBP for consumers of BVMs as if each were to purchase a new BVM in the expected year of required compliance with new or amended standards. New and amended standards would apply to BVMs manufactured 3 years after the date on which any new or amended standard is published. (42 U.S.C. 6295(v)(3)) At this time, DOE estimates publication of a final rule in 2025. Therefore, for purposes of its analysis, DOE used 2028 as the first year of compliance with any amended standards for BVMs.

Table IV.5 summarizes the approach and data DOE used to derive inputs to the LCC and PBP calculations. The subsections that follow provide further discussion. Details of the spreadsheet model, and of all the inputs to the LCC and PBP analyses, are contained in chapter 8 of the NOPR TSD and its appendices.

TABLE IV.5—SUMMARY OF INPUTS AND METHODS FOR THE LCC AND PBP ANALYSES*

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 component costs.
Installation Costs	Installation costs for BVMs are subsumed in the MSP and markup and not modeled as an incremental cost.
Annual Energy Use	The total annual energy use varies by equipment class and efficiency level. Based on engineering and energy use analyses.
Energy Prices	*Electricity:* Based on EIA's Form 861 data for 2021. *Variability:* Energy prices determined for 50 states and the District of Columbia.
Energy Price Trends	Based on *AEO2022* price projections. *Variability:* Energy price trends vary by nine census regions.
Repair, Refurbishment and Maintenance Costs	Based on RS Means and United States Bureau of Labor Statistics data. Vary by efficiency level.
Product Lifetime	*Average:* 13.4 years.
Discount Rates	Approach involves identifying all possible debt or asset classes that might be used to purchase the considered equipment, or might be affected indirectly. Primary data source was Damodaran Online.
Compliance Date	2028.

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

In the April 2022 Preliminary Analysis, DOE requested comment on the overall methodology and results of the LCC and PBP analyses. In response to that request, NAMA made three comments.

NAMA stated that DOE should factor the unprecedented increase in inflation into the economic analysis in addition

[37] Crystal Ball ™ is commercially available software tool to facilitate the creation of these types of models by generating probability distributions and summarizing results within Excel, available at *www.oracle.com/technetwork/middleware/crystalball/overview/index.html* (last accessed July 6, 2018).

to the design option costs. (NAMA No. 14, at p. 10)

DOE acknowledges the comment from NAMA and applies the annual implicit price deflators for gross domestic product (GDP) from the U.S. Bureau of Economic Analysis to the LCC and PBP analyses to capture the impact of price changes between the years of available cost data and the analysis year. Equipment and design option costs are developed in the engineering analysis and are incorporated into the LCC and PBP analyses by being reflected in the MPCs.

In response to the April 2022 Preliminary Analysis, NAMA commented to request that in the Economic Impact Analysis on the cost of labor, real cases from 2021 and 2022 are used rather than the cost of labor in 2018. (NAMA, No. 14 at p. 11)

DOE acknowledges the comment from NAMA and will use the most recent data available for the LCC and PBP analyses. If the most recent data available is from prior to 2021, the annual implicit price deflators for GDP from the U.S. Bureau of Economic Analysis will be used to reflect the costs in the year 2021.

NAMA commented that in the April 2022 Preliminary Analysis, the lower efficiency levels resulted in trivial energy savings and the higher efficiency levels showed a large portion of consumers experiencing a net cost in the LCC analysis. (NAMA, No. 14 at p. 15)

DOE acknowledges the comment from NAMA and will consider total energy savings and the portion of consumers experiencing net cost when proposing new energy efficiency standards.

In response to the April 2022 Preliminary Analysis, NAMA commented that it is only at low efficiency levels where consumers or business owners do not experience a net cost according to DOE's analysis, and that energy savings at those levels are trivial and do not justify DOE setting new energy efficiency standards for BVMs. (NAMA, No. 14 at p. 15)

DOE acknowledges the comment from NAMA and considers the percentage of customers that experience a net benefit ot net cost in addition to energy savings in the economic analysis to determine if the proposed rule is economically justified.

1. Equipment Cost

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

BVMs are made of many different components. DOE's research indicates flat future prices for a majority of the components of BVMs. DOE included future price reductions for semiconductor and similar technologies. Semiconductor technology price learning applies to efficiency levels that include design options with higher-efficiency evaporator and condenser fan motors (*i.e.,* ECM and permanent magnet synchronous (PMS) motors). Price learning applies to a proportion of the motor cost representing the semiconductor technology. Some variable speed compressors have price learning. Therefore, DOE applied price learning to compressor components in BVM equipment at efficiency levels that included variable speed compressors.

2. Installation Cost

Installation costs for BVMs are subsumed in the MSP and markup and not modeled as an incremental cost. DOE found no evidence that installation costs would be impacted with increased efficiency levels.

3. Annual Energy Consumption

For each sampled consumer, DOE determined the energy consumption for a BVM at different efficiency levels using the approach described previously in section IV.E of this document.

4. Energy Prices

DOE derived electricity prices from the EIA energy price data by sector and by state(EIA Form 861) for average electricity price data for the commercial and industrial sectors. DOE used projections of these electricity prices for commercial and industrial consumers to estimate future energy prices in the LCC and PBP analyses. EIA's *AEO2022* was used as the source of projections for future electricity prices.

DOE developed 2021 commercial and industrial retail electricity prices for each state and the District of Columbia based on EIA Form 861. To estimate energy prices in future years, DOE multiplied the 2021 energy prices by the projection of annual average price changes for each of the nine census divisions from the Reference case in *AEO2022,* which has an end year of 2050.[38] To estimate price trends after 2050, the 2041–2050 average was used for all years DOE used EIA's 2018 Commercial Building Energy Consumption Survey [39] (CBECS 2018) to determine the difference in commercial energy prices by building type. DOE applied the ratio of a specific building type's electricity prices to average commercial electricity prices in the LCC and PBP analyses.

DOE's methodology allows electricity prices to vary by sector, state, region, and building type. In the analysis, variability in electricity prices is chosen to be consistent with the way the consumer economic and energy use characteristics are defined in the LCC analysis. Chapter 8 of the NOPR TSD provides more detail about DOE's approach to developing energy prices and price trends.

5. Maintenance and Repair Costs

Repair costs are associated with repairing or replacing equipment components that have failed in an appliance; maintenance costs are associated with maintaining the operation of the product. Typically, small incremental increases in equipment efficiency entail no, or only minor, changes in repair and maintenance costs compared to baseline efficiency equipment. The repair cost is the cost to the consumer for replacing or repairing BVM components that have failed. For the LCC analysis, repair costs also include refurbishment costs and the cost of replacing BVM components routinely within the lifetime of a BVM. The LCC analysis models compressors, evaporator fan motors and condenser fan motors being repaired or replaced twice in the lifetime of the BVM. The maintenance cost is the cost to the consumer of maintaining equipment operation. Chapter 8 of the NOPR TSD provides more detail about DOE's maintenance, repair, and refurbishment cost calculations.

DOE request comments on the frequency and nature of compressor and motor repairs or replacements in BVMs.

6. Equipment Lifetime

For BVMs, DOE used information from various literature sources and input from manufacturers and other interested parties to establish equipment lifetimes for use in the LCC and PBP analyses. This analysis assumes an average lifetime of 13.4 years based on refurbishments of major components occurring twice during the life of the equipment at an interval of 4.5 years. This estimate is based on a 2010

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

[39] *www.eia.gov/consumption/commercial/.*

ENERGY STAR webinar,[40] which reported average lifetimes of 12 to 15 years, and data on the distribution of equipment ages in the stock of BVMs in the Pacific Northwest from the Northwest Power and Conservation Council 2007 Regional Technical Forum [41] (RTF), which observed the age of the units in service to be approximately 8 years on average.

In response to the April 2022 Preliminary Analysis, NAMA commented that DOE should develop a model showing what impact increasing the retail price of a new BVM has on purchasing refurbished machines and delaying purchases of new machines. (NAMA, No. 14 at p. 13) NAMA pointed out that any sale of a refurbished machine reduces the sales of a new machine designed to the new energy standards, thus increasing the amount of time that the overall impact on the net change to U.S. energy consumption of the United States by vending machines would occur. *Id.*

DOE acknowledges this comment and uses the data available to determine the lifetime assumptions of BVMs in the LCC and PBP analyses. DOE models two refurbishment processes, each adding to the average lifetime of equipment. DOE does not have data available to support how higher MSPs would impact the lifetime of BVMs. DOE uses the latest industry report to determine shipments and amount of annual shipments and sales of new BVMs.

7. Discount Rates

The discount rate is the rate at which future expenditures are discounted to establish their present value. In the calculation of LCC, DOE determined the discount rate by estimating the cost of capital for purchasers of BVMs. Most purchasers use both debt and equity capital to fund investments. Therefore, for most purchasers, the discount rate is the weighted-average cost of debt and equity financing, or the weighted-average cost of capital (WACC), less the expected inflation.

To estimate the WACC of BVM purchasers, DOE used a sample of nearly 1,200 companies grouped to be representative of operators of each of the commercial business types (health care, lodging, foodservice, retail, education, food sales, and offices) drawn from a database of 6,177 U.S. companies presented on the Damodaran Online website. This database includes most of the publicly traded companies in the United States. The WACC approach for determining discount rates accounts for the current tax status of individual firms on an overall corporate basis. DOE did not evaluate the marginal effects of increased costs, and, thus, depreciation due to more expensive equipment, on the overall tax status.

DOE used the final sample of companies to represent purchasers of BVMs. For each company in the sample, DOE combined company-specific information from the Damodaran Online website, long-term returns on the Standard & Poor's 500 stock market index from the Damodaran Online website, nominal long-term Federal government bond rates, and long-term inflation to estimate a WACC for each firm in the sample.

For most educational buildings and a portion of the office buildings and cafeterias occupied and/or operated by public schools, universities, and State and local government agencies, DOE estimated the cost of capital based on a 40-year geometric mean of an index of long-term tax-exempt municipal bonds (≤20 years). Federal office space was assumed to use the Federal bond rate, derived as the 40-year geometric average of long-term (≤10 years) U.S. government securities.

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).

To estimate the energy efficiency distribution of BVMs for 2028, DOE relied on publicly available energy use data. Specifically, the market efficiency distribution was determined separately for each equipment class for which certification information was available in the DOE certification [42] and ENERGY STAR databases.[43] The estimated market shares for the no-new-standards case for BVMs are shown in Table IV.6. See chapter 8 of the NOPR TSD for further information on the derivation of the efficiency distributions.

TABLE IV.6—EFFICIENCY LEVEL DISTRIBUTION WITHIN EACH EQUIPMENT CLASS IN NO-NEW-STANDARDS CASE FOR BEVERAGE VENDING MACHINES

Equipment class	Efficiency level							
	0 (%)	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	6 (%)	7 (%)
Class A	67	17	0	11	0	0	0	6
Class B	44	44	0	11	0	0	0	0
Combo A	47	6	0	24	18	0	6	0
Combo B	100	0	0	0	0	0	0	0

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

9. Split Incentives

DOE understands that, in most cases, the purchasers of BVMs (a bottler or a vending services company) do not pay the energy costs for operation and thus will not directly reap any energy cost savings from more efficient equipment. However, DOE assumes that BVM owners will seek to pass on higher equipment costs to the users who pay the energy costs, if possible. DOE

[40] EPA. ''Always Count Your Change, How ENERGY STAR Refrigerated Vending Machines Save Your Facility Money and Energy.'' 2010. *www.energystar.gov/ia/products/vending_machines/Vending_Machine_Webinar_Transcript.pdf.*

[41] Haeri, H., D. Bruchs, D. Korn, S. Shaw, J. Schott. Characterization and Energy Efficiency Opportunities in Vending Machines for the Northwestern US Market. Prepared for Northwest Power and Conservation Council Regional Technical Forum by Quantec, LLC and The Cadmus Group, Inc. Portland, OR. July 24, 2007.

[42] See *www.regulations.doe.gov/ccms.*

[43] See *www.energystar.gov/productfinder/product/certified-vending-machines/results.*

understands that the BVM owner typically has a financial arrangement with the company or institution on whose premises the BVM is located, in which the latter may pay a fee or receive a share of the revenue from the BVM. Thus, DOE expects that BVM owners could modify the arrangement to effectively pass on higher equipment costs. Therefore, DOE's LCC and PBP analyses uses the perspective that the company or institution on whose premises the BVM is located pays the higher equipment cost and receives the energy cost savings.

In response to the April 2022 Preliminary Analysis, NAMA commented that the purchaser of a refrigerated vending machine is typically not the company who will utilize the machine, and that the market explanation given in the April 2022 Preliminary Analysis TSD does not reflect this. (NAMA, No. 14 at p. 7)

DOE acknowledges the comment and agrees with NAMA that the purchaser of a BVM is not typically the same entity that utilizes the BVM and receives energy savings. DOE assumes in the LCC analysis that the increased purchase costs of higher-efficiency equipment is passed on to the entity that utilizes the BVM. The perspective of the LCC and PBP analyses is that the entity that utilizes the BVM effectively pays the higher equipment costs and receives the reduction in energy expenses.

10. Payback Period Analysis

The PBP is the amount of time (expressed in years) it takes the consumer to recover the additional installed cost of more efficient products, compared to baseline products, through energy cost savings. 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. DOE refers to this as a ''simple PBP'' because it does not consider changes over time in operating cost savings. The PBP calculation uses the same inputs as the LCC analysis when deriving first-year operating costs.

As noted previously, EPCA establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the consumer of purchasing equipment 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.[44] The shipments model takes an accounting approach, tracking market shares of each equipment class and the vintage of units in the stock. Stock accounting uses product shipments as inputs to estimate the age distribution of in service product stocks for all years. The age distribution of in service product stocks is a key input to calculations of both the NES and NPV, because operating costs for any year depend on the age distribution of the stock.

In the BVM NOPR analysis, DOE modeled shipments of BVMs based on data from Vending Times State of the Industry Reports.[45] The industry reports BVM stock trends that were averaged and used to model annual shipments. Chapter 9 of the NOPR TSD includes more details on the BVM shipments analysis.

NAMA stated that DOE should consider the impact of major supply chain issues, disruptions, and shortages from the past 24 months as part of the impact of new energy efficiency standard levels. (NAMA, No. 14 at p. 10)

In response to the April 2022 Preliminary Analysis, NAMA commented that although they were unable to do a detailed analysis of the percentage of Class A, Class B, Class Combo A, and Class Combo B BVMs against the models, they believe that the percentage of Class A and Class Combo A are under-represented by the DOE assumption. (NAMA, No. 14 at p. 6)

DOE recognizes that the industry has been disrupted in recent years; therefore, DOE's shipment analysis uses data from recent industry reports that reflect the 2020 and 2021 BVM industry and the changes from years prior to 2020.

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.[46] (''Consumer'' in this context refers to consumers of the equipment being regulated.) DOE calculates the NES and NPV for the potential standard levels considered based on projections of annual equipment 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, equipment costs, and NPV of consumer benefits over the lifetime of BVMs sold from 2028 through 2057.

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

DOE uses a spreadsheet model to calculate the energy savings and the national consumer costs and savings from each TSL. 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.7 summarizes the inputs and methods DOE used for the NIA analysis for the NOPR and discussion of these inputs and methods follows. See chapter 10 of the NOPR TSD for further details.

[44] 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.

[45] Annual Report: State of the Industry 2021 *cdn.baseplatform.io/files/base/cygnus/vmw/document/2022/06/autm_SOI_NoAds.62b3896290401.pdf.*

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

TABLE IV.7—SUMMARY OF INPUTS AND METHODS FOR THE NATIONAL IMPACT ANALYSIS

Inputs	Method
Shipments	Annual shipments from shipments model.
Compliance Date of Standard	2028.
Efficiency Trends	*No-new-standards case:* Standards cases:
Annual Energy Consumption per Unit	Annual weighted-average values are a function of energy use at each TSL.
Total Installed Cost per Unit	Annual weighted-average values are a function of cost at each TSL. Incorporates projection of future equipment prices based on historical data.
Annual Energy Cost per Unit	Annual weighted-average values as a function of the annual energy consumption per unit and energy prices.
Repair and Maintenance Cost per Unit	Annual values from the LCC analysis that increase with efficiency levels.
Energy Price Trends	*AEO2022* projections (to 2050) and extrapolation thereafter.
Energy Site-to-Primary and FFC Conversion	A time-series conversion factor based on *AEO2022*.
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 equipment classes for the year of anticipated compliance with an amended or new standard. To project the trend in efficiency absent amended standards for BVMs over the entire shipments projection period, DOE assumed that the efficiency distribution will remain the same in future years due to lack of information available to inform a different trend. The approach is further described in chapter 10 of the NOPR TSD.

To develop standards case efficiency trends after 2028, DOE applied a ''roll-up'' scenario approach to establish the efficiency distribution for the compliance year. Under the ''roll-up'' scenario, DOE assumed that (1) equipment efficiencies in the no-new-standards case that do not meet the standard level under consideration will ''roll-up'' to meet the new standard level, and (2) equipment efficiencies above the standard level under consideration will not be affected.

2. National Energy Savings

The national energy savings analysis involves a comparison of national energy consumption of the considered equipment between each potential standards case (TSL) and the case with no new or amended energy conservation standards. DOE calculated the national energy consumption by multiplying the number of units (stock) of each product (by vintage or age) by the unit energy consumption (also by vintage). DOE calculated annual NES based on the difference in national energy consumption for the no-new-standards case and for each higher-efficiency standard case. DOE estimated energy consumption and savings based on site energy and converted the electricity consumption and savings to primary energy (*i.e.,* the energy consumed by power plants to generate site electricity) using annual conversion factors derived from *AEO2022*. Cumulative energy savings are the sum of the NES for each year over the timeframe of the analysis.

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 GHGs 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[47] that EIA uses to prepare its *AEO*. 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 10D of the NOPR TSD.

In response to the April 2022 Preliminary Analysis, NAMA commented that they believe the national energy savings estimated by DOE as 0.152 quads for CSL 6 are in fact the FFC savings, and that DOE should not be advertising a savings of 0.152 when the data show less. (NAMA, No. 14 at p. 15)

DOE acknowledges the comment and understands that FFC savings will be higher than primary savings. Both primary and FFC savings are reported in section V.B.3 of this document.

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 BVM price trends based on historical PPI data. DOE applied the same trends to project prices for each product class at each considered efficiency level. PPI data was deflated using implicit GDP

[47] For more information on NEMS, refer to *The National Energy Modeling System: An Overview 2009*, DOE/EIA–0581(2009), October 2009. Available at *https://www.eia.gov/outlooks/aeo/nems/overview/pdf/0581(2009).pdf* (last accessed February 2023).

deflators and found to be constant on average. Although prices for overall BVM equipment were found to be constant, DOE developed component price trends for certain design options using historical PPI data for semiconductors and related devices. Efficiency levels that include ECM and PMS motors, and variable speed compressors have price learning applied to the appropriate portion of the MSP. DOE found that prices for semiconductor related components decreased by 5.88 percent annually. DOE's projection of equipment prices is described in chapter 10 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 BVMs. In addition to the default price trend, DOE considered two product price sensitivity cases: (1) a high price decline case based on PPI data up to 2005 and (2) a low price decline case based on PPI data from 2005 onward. The derivation of these price trends are described in chapter 8 of the NOPR TSD.

The energy cost savings are calculated using the estimated electricity savings in each year and the projected price of electricity. To estimate energy prices in future years, DOE multiplied the average regional energy prices by the projection of annual national-average energy price changes in the *AEO2022* Reference case, which has an end year of 2050. To estimate price trends after 2050, the 2035–2050 average was used for all years. As part of the NIA, DOE also analyzed scenarios that used inputs from variants of the *AEO2022* 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 10B 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.[48] 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 identified manufacturing facilities that purchase their own BVMs as a relevant subgroup. These facilities typically have higher discount rates and lower electricity prices than the general population of BVM consumers. These two conditions make it likely that this subgroup will have the lowest LCC savings of any major consumer subgroup.

DOE used the LCC and PBP spreadsheet model to estimate the impacts of the considered efficiency levels on this subgroup. Chapter 11 in the NOPR TSD describes the consumer subgroup analysis.

J. Manufacturer Impact Analysis

1. Overview

DOE performed an MIA to estimate the financial impacts of amended energy conservation standards on manufacturers of BVMs and to estimate the potential impacts of such standards on 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 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 WACC, 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 (TSLs). To capture the uncertainty relating to manufacturer pricing strategies following amended standards, the GRIM estimates a range of possible impacts under different markup scenarios.

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

DOE conducted the MIA for this rulemaking in three phases. In Phase 1 of the MIA, DOE prepared a profile of the BVM manufacturing industry based on the market and technology assessment, preliminary manufacturer interviews, and publicly available information. This included a top-down analysis of BVM 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 BVM manufacturing industry, including company filings of form 10–K from the SEC,[49] corporate annual reports, the

[48] United States Office of Management and Budget. *Circular A–4: Regulatory Analysis.* September 17, 2003. Section E. Available at *georgewbush-whitehouse.archives.gov/omb/memoranda/m03-21.html* (last accessed February 2023).

[49] U.S. Securities and Exchange Commission. Company Filings. Available at *https://www.sec.gov/edgar/searchedgar/companysearch.html.*

U.S. Census Bureau's *Economic Census*,[50] and reports from Dunn & Bradstreet.[51]

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 BVMs in order to develop other key GRIM inputs, including product and capital conversion costs, and to gather additional information on the anticipated effects of energy conservation standards on revenues, direct employment, capital assets, industry competitiveness, and subgroup impacts.

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

[50] The U.S. Census Bureau. Quarterly Survey of Plant Capacity Utilization. Available at *www.census.gov/programs-surveys/qpc/data/tables.html.*

[51] The Dun & Bradstreet Hoovers login is available at *app.dnbhoovers.com.*

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, markups, shipments, and industry financial information as inputs. The GRIM models changes in costs, distribution of shipments, investments, and manufacturer margins that could result from an amended energy conservation standard. The GRIM spreadsheet uses the inputs to arrive at a series of annual cash flows, beginning in 2023 (the base year of the analysis) and continuing to 2057. DOE calculated INPVs by summing the stream of annual discounted cash flows during this period. For manufacturers of BVMs, DOE used a real discount rate of 8.5 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 information gathered from industry stakeholders during the course of manufacturer interviews. The GRIM results are presented in section V.B.2 of this document. Additional details about the GRIM, the discount rate, and other financial parameters can be found in chapter 12 of the NOPR TSD.

a. Manufacturer Production Costs

Manufacturing more efficient equipment is typically more expensive than manufacturing baseline equipment due to the use of more complex components, which are typically more costly than baseline components. The changes in the MPCs of covered products can affect the revenues, gross margins, and cash flow of the industry.

As discussed in section IV.C.1 of this document, DOE conducted a market analysis of currently available models listed in DOE's CCD to determine which efficiency levels were most representative of the current distribution of BVMs available on the market. DOE determined MPCs using teardowns and feedback received from manufacturers during interviews. See chapter 5 of the NOPR TSD for additional details.

DOE seeks comment on the method for estimating manufacturing production costs.

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

b. Shipments Projections

The GRIM estimates manufacturer revenues based on total unit shipment projections and the distribution of those shipments by efficiency level. Changes in sales volumes and efficiency mix over time can significantly affect manufacturer finances. For this analysis, the GRIM uses the NIA's annual shipment projections derived from the shipments analysis from 2023 (the base year) to 2057 (the end year of the analysis period). See chapter 9 of the NOPR TSD for additional details.

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.

To evaluate the level of conversion costs manufacturers would likely incur to comply with amended energy conservation standards, DOE relied on estimates of equipment and tooling from feedback from manufacturer interviews. DOE contractors reached out to all five of the original equipment manufacturers (OEMs) identified in the CCD database, two of which agreed to be interviewed. These two OEMs are manufacturers of Class A, Class B, Combo A, and Combo B equipment. DOE used market share weighted feedback from the interviews to extrapolate industry-level product conversion costs from the manufacturer feedback.

Feedback from manufacturers on capital and product conversion costs allowed DOE to create industry estimates, scaled by market share and model count, in order to model the incremental investment required at different efficiency levels.

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 non-production cost 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 markup 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 markup scenario and (2) a preservation of per-unit operating profit markup scenario. These scenarios lead to different 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'' markup across all efficiency levels, which assumes that manufacturers would be able to maintain the same amount of profit as a percentage of revenues at all efficiency levels within a product class. As manufacturer production costs increase with efficiency, this scenario implies that the per-unit dollar profit will increase. DOE estimated gross margin percentages of 22 percent for Class A, 17 percent for Class B, 36 percent for Combo A, and 36 percent for Combo B. 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 to industry profitability under an amended energy conservation standard.

Under the preservation of per-unit operating profit markup scenario, DOE modeled a situation in which manufacturers are not able to increase per-unit operating profit in proportion to increases in manufacturer production costs. 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 no-new-standards 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 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. A comparison of industry financial impacts under the two manufacturer markup scenarios is presented in section V.B.2.a of this document.

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

3. Manufacturer Interviews

DOE interviewed two of the five OEMs identified in the CCD. Participants included manufacturers of Class A, Class B, and Combo B BVMs.

In interviews, DOE asked manufacturers to describe their major concerns regarding this proposed rulemaking. 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.

Manufacturers raised concerns about the potentially high levels of investment necessary under updated standards, citing high conversion costs associated with increased insulation thickness and VIPs. In particular, these changes would necessitate large investments in tooling and product redesign.

Manufacturers also cited concern regarding cost of the potential concurrent refrigerant transition outlined in the recent EPA rulemaking. This transition will require manufacturers to make investments independent of amended DOE standards.

Manufacturers also raised concern over the feasibility of further efficiency improvements, citing the incorporation of many DOE design options into baseline equipment. As an example, some of the design options included in the preliminary analysis are already incorporated in baseline models, such as evaporator fan motor controllers and high-efficiency lighting.

4. Discussion of MIA Comments

In response to the April 2022 Preliminary Analysis, NAMA commented that the 6-year ''lock-in'' provision in the statutory structure is designed to give manufacturers time to generate sufficient cash flow to recoup any necessary investments and financial costs/returns, and that when there are multiple regulations on the same product within the 6-year lock-in period (such as refrigerant transition, a new test procedure on payment systems, and new energy efficiency regulations), the second regulation violates the recoupment assumption inherent in the first one. (NAMA, No. 14 at p. 16–17) EPCA provides that, not later than 6 years after the issuance of any final rule establishing or amending a standard, DOE must publish either a notice of determination that standards for the product do not need to be amended, or a NOPR including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m)(1)) Although DOE considers cumulative regulatory burden in its analysis, DOE does not have the authority to delay review of its regulations in accordance with EPCA due to regulations issued by other Federal agencies.

NAMA stated that the existing GRIM model does not consider this situation, and that it produces an increase in value from the early write-off of any past investment. *Id.* NAMA noted that the GRIM accelerates depreciation (a non-cash item) due to the early write-off of past investment, by lowering tax cash costs, and that the simplest way to resolve this is to do a consolidated analysis for multiple regulations starting from the time of the first regulation. (NAMA, No. 14 at p. 17) NAMA added that although DOE has noted that such an analysis would require counting both the costs/investments and revenues/profits for both products, this is correct and is a feature, not a deficiency. *Id.* NAMA commented that DOE should be analyzing and assessing the change in combined industry value for these products, or for the same product multiple times. *Id.* NAMA stated that if this is not possible, then DOE should incorporate a value reduction factor in the first post-regulation year of the analysis that subtracts the value lost from the remaining years of the previous regulation. *Id.* NAMA also commented that it urged DOE to incorporate the financial results of the current Cumulative Regulatory Burden analysis directly into the MIA. (NAMA, No. 14 at p. 17) NAMA suggested doing this by adding the combined costs of complying with multiple regulations into the product conversion costs in the GRIM model. *Id.* NAMA commented that an appropriate approach would be to include the costs to manufacturers of responding to and monitoring regulations. *Id.*

NAMA also made a range of comments related to the phase out of certain refrigerants under consideration by the EPA. DOE notes that the costs associated with the refrigerant transition are not a direct result of amended standards, however DOE has considered the implications of these transition costs in its analysis.

DOE did not publish a GRIM in the preliminary analysis phase. However, DOE has published a GRIM as part of the NOPR analysis. In that GRIM DOE accounts for the investments manufacturers must make in order to adopt R–290 as a refrigerant for BVMs in 2025.

DOE analyzes cumulative regulatory burden pursuant to the Process Rule. Pursuant to the Process Rule, DOE will recognize and consider the overlapping effects on manufacturers of new or revised DOE standards and other Federal regulatory actions affecting the same products or equipment. The results of this analysis can be found in section V.B.2.e of this document.

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 GHGs, 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 *AEO2022.* Power sector emissions of CH_4 and N_2O from fuel combustion are estimated using Emission Factors for Greenhouse Gas Inventories published by the EPA.[52] 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 national impact analysis.

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. *AEO2022* generally represents current legislation and environmental regulations, including recent government actions, that were in place at the time of preparation of *AEO2022,* including the emissions control programs discussed in the following paragraphs.[53]

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.[54] *AEO2022* 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. In order to continue operating, coal power plants must have either flue gas desulfurization or dry sorbent injection systems installed. Both technologies, which are used to reduce acid gas emissions, also reduce SO_2 emissions. 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

[52] Available at *www.epa.gov/sites/production/files/2021-04/documents/emission-factors_apr2021.pdf.* Last accessed July 12, 2021.

[53] For further information, see the Assumptions to *AEO2022* 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 February 15, 2023).

[54] 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).

generation would generally reduce SO_2 emissions. DOE estimated SO_2 emissions reduction using emissions factors based on *AEO2022.*

CSAPR also established limits on NO_X emissions for numerous States in the eastern half of the United States. Energy conservation standards would have little effect on NO_X emissions in those States covered by CSAPR emissions limits if excess NO_X emissions allowances resulting from the lower electricity demand could be used to permit offsetting increases in NO_X emissions from other EGUs. In such a case, NO_X emissions would remain near the limit even if electricity generation goes down. A different case could possibly result, depending on the configuration of the power sector in the different regions and the need for allowances, such that NO_X emissions might not remain at the limit in the case of lower electricity demand. In this case, energy conservation standards might reduce NO_X emissions in covered States. Despite this possibility, DOE has chosen to be conservative in its analysis and has maintained the assumption that 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 *AEO2022* 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 *AEO2022,* 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 (E.O.) 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.

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

1. Monetization of Greenhouse Gas Emissions

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

DOE exercises its own judgment in presenting monetized climate benefits as recommended by applicable Executive Orders, and DOE would reach the same conclusion presented in this proposed rulemaking in the absence of SC–GHGs. That is, SC–GHGs, whether measured using the February 2021 interim estimates presented by the IWG or by another means, did not affect the rule ultimately proposed by DOE.

DOE estimated the global social benefits of CO_2, CH_4, and N_2O reductions using SC–GHG values that were based on the interim values presented in the *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990,* published in February 2021 by the IWG. 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 1 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–GHGs until revised estimates have been developed reflecting the latest, peer-reviewed science.

The SC–GHG estimates presented here were developed over many years, using a transparent process, peer-reviewed methodologies, the best science available at the time of that process, and input from the public. Specifically, in 2009, the IWG, which included DOE and other executive branch agencies and offices, was established to ensure that agencies were using the best available science and to promote consistency in the 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.*[55] and underwent a standard double-blind peer review process prior to journal publication. In 2015, as part of the response to public comments received for a 2013 solicitation for comments on the SC–CO_2 estimates, the IWG announced a National Academies of Sciences, Engineering, and Medicine review of the SC–CO_2 estimates to offer advice on how to approach future updates to ensure that the estimates continue to reflect the best available science and methodologies. In January 2017, the National Academies released

[55] 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 US Government's SC–CO_2 estimates. *Climate Policy.* 2015. 15(2): pp. 272–298.

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.[56] Shortly thereafter, in March 2017, President Trump issued E.O. 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.'' (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.

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 GHGs 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 Executive order 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 Executive order 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 United States 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; 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 United States 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,[57] and recommended that discount rate uncertainty and relevant aspects of intergenerational ethical considerations be accounted for in selecting future discount rates.

Furthermore, the damage estimates developed for use in the SC–GHG are estimated in consumption-equivalent terms, and so an application of OMB Circular A–4's guidance for regulatory analysis would then use the consumption discount rate to calculate the SC–GHG. DOE agrees with this assessment and will continue to follow developments in the literature pertaining to this issue. DOE also notes that while OMB Circular A–4, as published in 2003, recommends using 3-percent and 7-percent discount rates as ''default'' values, Circular A–4 also reminds agencies that ''different

[56] 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.

[57] Interagency Working Group on Social Cost of Carbon. *Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866.* 2010. United States Government. (Last accessed April 15, 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 April 15, 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 January 18, 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 January 18, 2022.) *www.epa.gov/sites/default/files/2016-12/documents/addendum_to_sc-ghg_tsd_august_2016.pdf.*

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-percent discount rate is not appropriate to apply to value the SC–GHGs in the analysis presented in this analysis.

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

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

There are a number of limitations and uncertainties associated with the SC–GHG estimates. First, the current scientific and economic understanding of discounting approaches suggests discount rates appropriate for intergenerational analysis in the context of climate change are likely to be less than 3 percent, near 2 percent or lower.[58] 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 integrated assessment models, their incomplete treatment of adaptation and technological change, the incomplete way in which inter-regional and intersectoral linkages are modeled, uncertainty in the extrapolation of damages to high temperatures, and inadequate representation of the relationship between the discount rate and uncertainty in economic growth over long time horizons. Likewise, the socioeconomic and emissions scenarios used as inputs to the models do not reflect new information from the last decade of scenario generation or the full range of projections. The modeling limitations do not all work in the same direction in terms of their influence on the SC–CO_2 estimates. However, as discussed in the February 2021 TSD, the IWG has recommended that, taken together, the limitations suggest that the interim SC–GHG estimates used in this proposed rule likely underestimate the damages from GHG emissions. DOE concurs with this assessment.

DOE's derivations of the SC–CO_2, SC–N_2O, and SC–CH_4 values used for this NOPR are discussed in the following sections, and the results of DOE's analyses estimating the benefits of the reductions in emissions of these GHGs are presented in section V.B.6 of this document.

a. Social Cost of Carbon

The SC–CO_2 values used for this NOPR were based on the values presented for the IWG's February 2021 TSD. Table IV.7 shows the updated sets of SC–CO_2 estimates from the IWG's TSD in 5-year increments from 2020 to 2050. The full set of annual values that DOE used is presented in appendix 14A of the NOPR TSD. For purposes of capturing the uncertainties involved in the regulatory impact analysis, DOE has determined it is appropriate to include all four sets of SC–CO_2 values, as recommended by the IWG.[59]

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

[59] 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.8—ANNUAL SC–CO_2 VALUES FROM 2021 INTERAGENCY UPDATE, 2020–2050

[2021$ 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 SC–CO_2 estimates published by EPA, adjusted to 2021$.[60] These estimates are based on methods, assumptions, and parameters identical to the 2020–2050 estimates published by the IWG (which were based on EPA modeling).

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 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 based on the values developed for the February 2021 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 14A of the NOPR TSD. To capture the uncertainties involved in the 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.9—ANNUAL SC–CH_4 AND SC–N_2O VALUES FROM 2021 INTERAGENCY UPDATE, 2020–2050

[2021$ per metric ton]

Year	SC–CH_4				SC–N_2O			
	Discount rate and statistic				Discount rate and statistic			
	5% Average	3% Average	2.5% Average	3% 95th Percentile	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020	670	1,500	2,000	3,900	5,800	18,000	27,000	48,000
2025	800	1,700	2,200	4,500	6,800	21,000	30,000	54,000
2030	940	2,000	2,500	5,200	7,800	23,000	33,000	60,000
2035	1,100	2,200	2,800	6,000	9,000	25,000	36,000	67,000
2040	1,300	2,500	3,100	6,700	10,000	28,000	39,000	74,000
2045	1,500	2,800	3,500	7,500	12,000	30,000	42,000	81,000
2050	1,700	3,100	3,800	8,200	13,000	33,000	45,000	88,000

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 GDP from the Bureau of Economic Analysis. To calculate a present value of the stream of monetary values, DOE discounted the values in each of the cases using the specific discount rate that had been used to obtain the SC–CH_4 and SC–N_2O estimates in each case.

2. Monetization of Other Emissions Impacts

For the NOPR, DOE estimated the monetized value of NO_X and SO_2 emissions reductions from electricity generation using the latest benefit per ton estimates for that sector from the EPA's Benefits Mapping and Analysis Program.[61] DOE used EPA's values for $PM_{2.5}$-related benefits associated with NO_X and SO_2 and for ozone-related benefits associated with NO_X for 2025, 2030, and 2040, calculated with discount rates of 3 percent and 7 percent. DOE used linear interpolation to define values for the years not given in the 2025 to 2040 period; for years beyond 2040, the values are held constant. DOE combined the EPA benefit per ton estimates with regional information on electricity consumption and emissions to define weighted-average national values for NO_X and SO_2 as a function of sector (see appendix 14B of the NOPR TSD).

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 *AEO2022*. NEMS produces the *AEO*

[60] See EPA, *Revised 2023 and Later Model Year Light-Duty Vehicle GHG Emissions Standards: Regulatory Impact Analysis,* Washington, DC, December 2021. Available at: *nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1013ORN.pdf* (last accessed January 13, 2023).

[61] *Estimating the Benefit per Ton of Reducing $PM_{2.5}$ Precursors from 21 Sectors. www.epa.gov/benmap/estimating-benefit-ton-reducing-pm25-precursors-21-sectors.*

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 *AEO2022* Reference case and various side cases. Details of the methodology are provided in the appendices to chapters 13 and 15 of the NOPR TSD.

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

N. Employment Impact Analysis

DOE considers employment impacts in the domestic economy as one factor in selecting a proposed standard. Employment impacts from new or amended energy conservation standards include both direct and indirect impacts. Direct employment impacts are any changes in the number of employees of manufacturers of the equipment subject to standards, their suppliers, and related service firms. 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 the Labor Department's Bureau of Labor Statistics (BLS). BLS regularly publishes its estimates of the number of jobs per million dollars of economic activity in different sectors of the economy, as well as the jobs created elsewhere in the economy by this same economic activity. Data from BLS indicate that expenditures in the utility sector generally create fewer jobs (both directly and indirectly) than expenditures in other sectors of the economy.[62] 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 (ImSET).[63] 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 that has 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 there are uncertainties involved in projecting long-term 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 overestimate actual job impacts over the long run for this rule. Therefore, DOE used ImSET only to generate results for near-term timeframes, 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 BVMs. It addresses the TSLs examined by DOE, the projected impacts of each of these levels if adopted as energy conservation standards for BVMs, 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 equipment 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 BVMs. DOE developed TSLs that combine efficiency levels for each analyzed equipment class. Table V.1 presents the TSLs and the corresponding efficiency levels that DOE has identified for potential amended energy conservation standards for BVMs. TSL 5 represents the max-tech energy efficiency for all equipment classes. TSL 4 represents the efficiency levels with the maximum NPV at 3 percent. TSL 3 represents the maximum efficiency level with positive NPV at 7 percent and positive average LCC savings for each equipment class. As shown in Table V.1, TSL 3 includes higher efficiency products for Class B, Combo A, and Combo B than TSL 4. The TSL ordering is based on total NES, which is greater in TSL 4 due to Class A representing over half of BVM shipments. TSL 2 represents efficiency levels with maximum LCC savings. TSL 1 represents EL2 for all equipment classes. DOE presents the results for the TSLs in this document, while the results for all efficiency levels that DOE analyzed are in the NOPR TSD.

[62] *See* U.S. Department of Commerce—Bureau of Economic Analysis. *Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II).* 1997. U.S. Government Printing Office: Washington, DC. Available at *https://www.bea.gov/sites/default/files/methodologies/RIMSII_User_Guide.pdf* (last accessed February 2023).

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

TABLE V.1—TRIAL STANDARD LEVELS FOR BEVERAGE VENDING MACHINES

Equipment class	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Class A	EL2	EL3	EL5	EL6	EL 7
Class B	EL2	EL3	EL5	EL4	EL 7
Combo A	EL2	EL3	EL5	EL4	EL 7
Combo B	EL2	EL4	EL6	EL5	EL 7

Table V.2 presents the TSLs and the corresponding percent reduction below the baseline daily energy consumption for each equipment class.

TABLE V.2—TRIAL STANDARD LEVELS FOR BEVERAGE VENDING MACHINES

Equipment class	TSL 1 (%)	TSL 2 (%)	TSL 3 (%)	TSL 4 (%)	TSL 5 (%)
Class A	15	20	30	37	47.6
Class B	25	30	40	35	59.6
Combo A	20	25	35	30	48.9
Combo B	25	40	50	45	62.9

DOE constructed the TSLs for this NOPR to include efficiency levels representative of efficiency levels with similar characteristics (*i.e.,* using similar technologies and/or efficiencies, and having roughly comparable equipment availability). The use of representative efficiency levels provided for greater distinction between the TSLs. While representative efficiency levels were included in the TSLs, DOE considered all efficiency levels as part of its analysis.[64]

B. Economic Justification and Energy Savings

1. Economic Impacts on Individual Consumers

DOE analyzed the economic impacts on BVM consumers by looking at the effects that potential amended standards at each TSL would have on the LCC and PBP analyses. 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 equipment affects consumers in two ways: (1) purchase price increases and (2) annual operating costs decrease. Inputs used for calculating the LCC and PBP include total installed costs (*i.e.,* product price plus installation costs) and operating costs (*i.e.,* annual energy use, energy prices, energy price trends, repair costs, and maintenance costs). The LCC calculation also uses product lifetime and a discount rate. Chapter 8 of the NOPR TSD provides detailed information on the LCC and PBP analyses.

Table V.3 shows LCC and PBP results by TSL including the shipment weighted average results for each TSL. Table V.4 through Table V.11 show the LCC and PBP results for the TSLs considered for each equipment class. In the first of each pair of tables, the simple payback is measured relative to the baseline equipment. 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 equipment with higher efficiency in the no-new-standards case, the average savings are less than the difference between the average LCC of the baseline product and the average LCC at each TSL. The savings refer only to consumers who are affected by a standard at a given TSL. Those who already purchase a product with efficiency at or above a given TSL are not affected. Consumers for whom the LCC increases at a given TSL experience a net cost.

The analysis results indicate that consumers either benefit or are unaffected by setting standards at TSLs 1 or 2. At TSL 3, 28 percent of the market would experience net costs and at TSL 4, 34 percent of the market for BVMs would experience a net cost.

TABLE V.3—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR BEVERAGE VENDING MACHINES

Equipment class	Average LCC savings * (2021$)	Consumers that experience net cost (%)	Average LCC savings * (2021$)	Consumers that experience net cost (%)	Average LCC savings * (2021$)	Consumers that experience net cost (%)
	TSL 1		TSL 2		TSL 3	
Class A	$150	0	$203	0	$99	28
Class B	167	0	212	0	146	17
Combo A	212	0	263	0	43	49
Combo B	214	0	326	0	94	37
Weighted Average **	166	0	222	0	107	28
	TSL 4		TSL 5			
Class A	(6)	59	(695)	93		
Class B	206	2	(199)	84		

[64] Efficiency levels that were analyzed for this NOPR are discussed in section IV.E of this document. Results by efficiency level are presented in TSD chapters 8, 10, and 12.

TABLE V.3—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR BEVERAGE VENDING MACHINES—Continued

Equipment class	Average LCC savings * (2021$)	Consumers that experience net cost (%)	Average LCC savings * (2021$)	Consumers that experience net cost (%)	Average LCC savings * (2021$)	Consumers that experience net cost (%)
Combo A	190	12	(851)	99		
Combo B	287	0	(239)	85		
Weighted Average **	97	34	(532)	90		

* LCC savings reflect affected consumers only.
** Weighted by shares of each equipment class in total projected shipments in 2028.

TABLE V.4—AVERAGE LCC AND PBP RESULTS FOR BEVERAGE VENDING MACHINES CLASS A

TSL	Efficiency level	Average costs (2021$)				Simple payback (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	Baseline	$3,970	$495	$5,621	$9,591		13.4
1	2	3,979	477	5,440	9,418	0.5	13.4
2	3	3,987	471	5,379	9,366	0.7	13.4
3	5	4,118	458	5,328	9,446	4.0	13.4
4	6	4,228	450	5,322	9,551	5.7	13.4
5	7	5,034	437	5,206	10,240	18.3	13.4

TABLE V.5—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR CLASS A

TSL	Efficiency level	Life-cycle cost savings	
		Average LCC savings * (2021$)	Percent of consumers that experience net cost (%)
1	2	$150	0
2	3	203	0
3	5	99	28
4	6	(6)	59
5	7	(695)	93

* LCC savings reflect affected consumers only.

TABLE V.6—AVERAGE LCC AND PBP RESULTS FOR BEVERAGE VENDING MACHINES CLASS B

TSL	Efficiency level	Average costs (2021$)				Simple payback (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	$3,178	$474	$5,412	$8,590		13.4
1	2	3,193	449	5,160	8,353	0.6	13.4
2	3	3,199	444	5,109	8,308	0.7	13.4
3	5	3,294	434	5,058	8,351	2.8	13.4
4	4	3,220	439	5,071	8,292	1.2	13.4
5	7	3,736	414	4,960	8,696	9.2	13.4

TABLE V.7—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR BEVERAGE VENDING MACHINES CLASS B

TSL	Efficiency level	Life-cycle cost savings	
		Average LCC savings * (2021$)	Percent of consumers that experience net cost (%)
1	2	$167	0
2	3	212	0
3	5	146	17
4	4	206	2
5	7	(199)	84

* LCC savings reflect affected consumers only.

TABLE V.8—AVERAGE LCC AND PBP RESULTS FOR BEVERAGE VENDING MACHINES COMBO A

TSL	Efficiency level	Average costs (2021$)				Simple payback (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	$3,990	$489	$5,551	$9,541	....	13.4
1	2	3,998	466	5,321	9,319	0.4	13.4
2	3	4,005	460	5,264	9,268	0.5	13.4
3	5	4,145	448	5,224	9,369	3.8	13.4
4	4	4,037	454	5,223	9,260	1.4	13.4
5	7	5,097	432	5,175	10,272	19.5	13.4

TABLE V.9—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR BEVERAGE VENDING MACHINES COMBO A

TSL	Efficiency level	Life-cycle cost savings	
		Average LCC savings * (2021$)	Percent of consumers that experience net cost (%)
1	2	212	0
2	3	263	0
3	5	43	49
4	4	190	12
5	7	(851)	99

* LCC savings reflect affected consumers only.

TABLE V.10—AVERAGE LCC AND PBP RESULTS FOR BEVERAGE VENDING MACHINES COMBO B

TSL	Efficiency level	Average costs (2021$)				Simple payback (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	$3,725	$463	$5,297	$9,023	....	13.4
1	2	3,735	441	5,073	8,809	0.4	13.4
2	4	3,758	427	4,939	8,697	0.9	13.4
3	6	3,956	418	4,972	8,928	5.1	13.4
4	5	3,814	423	4,921	8,736	2.2	13.4
5	7	4,347	406	4,914	9,261	10.9	13.4

TABLE V.11—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR BEVERAGE VENDING MACHINES COMBO B

TSL	Efficiency level	Life-cycle cost savings	
		Average LCC savings * (2021$)	Percent of consumers that experience net cost (%)
1	2	$214	0
2	4	326	0
3	6	94	37
4	5	287	0
5	7	(239)	85

* LCC savings reflect affected consumers only.

b. Consumer Subgroup Analysis

In the consumer subgroup analysis, DOE estimated the impact of the considered TSLs on manufacturing facilities that purchase their own BVMs due to the lower electricity prices and higher discount rates compared to other BVM consumer building types. DOE identified manufacturing facilities that purchase their own BVMs as a relevant subgroup because these facilities typically have higher discount rates and lower electricity prices than the general population of BVM consumers. These two conditions make it likely that this subgroup will have the lowest LCC savings of any major consumer subgroup. Table V.12 through Table V.15 compare the average LCC savings and PBP at each efficiency level for the consumer subgroup with similar metrics for the entire consumer sample for BVMs. Chapter 11 of the NOPR TSD presents the complete LCC and PBP results for the subgroup analysis.

TABLE V.12—COMPARISON OF LCC SAVINGS AND PBP FOR CONSUMER SUBGROUPS AND ALL BUILDINGS; CLASS A

	Manufacturing	Full building sample
Average LCC Savings * (2021$)		
TSL 1	$105	$150
TSL 2	141	203
TSL 3	15	99
TSL 4	(109)	(6)
TSL 5	(834)	(695)
Payback Period (years)		
TSL 1	0.6	0.5
TSL 2	0.9	0.7
TSL 3	5.2	4.0
TSL 4	7.4	5.7
TSL 5	23.7	18.3
Consumers With Net Benefit (%)		
TSL 1	84	84
TSL 2	84	84
TSL 3	41	67
TSL 4	14	36
TSL 5	0	2
Consumers With Net Cost (%)		
TSL 1	0	0
TSL 2	0	0
TSL 3	53	28
TSL 4	81	59
TSL 5	94	93

* The savings represent the average LCC for affected consumers.

TABLE V.13—COMPARISON OF LCC SAVINGS AND PBP FOR CONSUMER SUBGROUPS AND ALL BUILDINGS; CLASS B

	Manufacturing	Full building sample
Average LCC Savings * (2021$)		
TSL 1	$117	$167
TSL 2	147	212
TSL 3	63	146
TSL 4	135	206
TSL 5	(332)	(199)
Payback Period (years)		
TSL 1	0.8	0.6
TSL 2	0.9	0.7
TSL 3	3.7	2.8
TSL 4	1.5	1.2
TSL 5	11.9	9.2
Consumers With Net Benefit (%)		
TSL 1	89	89
TSL 2	89	89
TSL 3	69	83
TSL 4	93	98
TSL 5	6	16
Consumers With Net Cost (%)		
TSL 1	0	0
TSL 2	0	0
TSL 3	31	17
TSL 4	7	2
TSL 5	94	84

* The savings represent the average LCC for affected consumers.

TABLE V.14—COMPARISON OF LCC SAVINGS AND PBP FOR CONSUMER SUBGROUPS AND ALL BUILDINGS; COMBO A

	Manufacturing	Full building sample
Average LCC Savings* (2021$)		
TSL 1	$149	$212
TSL 2	184	263
TSL 3	(25)	43
TSL 4	120	190
TSL 5	(953)	(851)
Payback Period (years)		
TSL 1	0.5	0.4
TSL 2	0.7	0.5
TSL 3	4.9	3.8
TSL 4	1.8	1.4
TSL 5	25.3	19.5
Consumers With Net Benefit (%)		
TSL 1	52	52
TSL 2	52	52
TSL 3	31	45
TSL 4	57	64
TSL 5	0	1
Consumers With Net Cost (%)		
TSL 1	0	0
TSL 2	0	0
TSL 3	63	49
TSL 4	19	12
TSL 5	100	99

* The savings represent the average LCC for affected consumers.

TABLE V.15—COMPARISON OF LCC SAVINGS AND PBP FOR CONSUMER SUBGROUPS AND ALL BUILDINGS; COMBO B

	Manufacturing	Full building sample
Average LCC Savings* (2021$)		
TSL 1	$150	$214
TSL 2	224	326
TSL 3	(25)	94
TSL 4	174	287
TSL 5	(387)	(239)
Payback Period (years)		
TSL 1	0.6	0.4
TSL 2	1.2	0.9
TSL 3	6.6	5.1
TSL 4	2.8	2.2
TSL 5	14.2	10.9
Consumers With Net Benefit (%)		
TSL 1	100	100
TSL 2	100	100
TSL 3	22	63
TSL 4	100	100
TSL 5	3	15
Consumers With Net Cost (%)		
TSL 1	0	0
TSL 2	0	0
TSL 3	78	37
TSL 4	0	0
TSL 5	97	85

* The savings represent the average LCC for affected consumers.

c. Rebuttable Presumption Payback

As discussed in section II.A of this document, EPCA establishes a rebuttable presumption that an energy conservation standard is economically justified if the increased purchase cost for equipment that meets the standard is less than three times the value of the first-year energy savings resulting from the standard. In calculating a rebuttable presumption PBP 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 BVMs. In contrast, the PBPs presented in section V.B.1.a of this document were calculated using distributions that reflect the range of energy use in the field.

Table V.16 presents the rebuttable presumption PBPs for the considered TSLs for BVMs. While DOE examined the rebuttable presumption criterion, it considered whether the standard levels considered for the NOPR are economically justified through a more detailed analysis of the economic impacts of those levels, pursuant to 42 U.S.C. 6295(o)(2)(B)(i), that considers the full range of impacts to the consumer, manufacturer, Nation, and environment. The results of that analysis serve as the basis for DOE to definitively evaluate the economic justification for a potential standard level, thereby supporting or rebutting the results of any preliminary determination of economic justification.

TABLE V.16 REBUTTABLE PRESUMPTION PAYBACK PERIODS

Equipment class	Median payback period (years)				
	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Class A	0.4	0.5	2.3	4.0	5.7
Class B	0.6	0.6	1.2	0.7	4.4
Combo A	0.4	0.4	1.4	0.5	6.5
Combo B	0.4	0.5	2.2	0.9	5.1

2. Economic Impacts on Manufacturers

DOE performed an MIA to estimate the impact of amended energy conservation standards on manufacturers of BVMs. 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. Table V.17 and Table V.18 summarize the estimated financial impacts (represented by changes in INPV) of potential amended energy conservation standards on manufacturers of BVMs, as well as the conversion costs that DOE estimates manufacturers of BVMs would incur at each TSL.

As discussed in section IV.J.2.d of this document, DOE modeled two scenarios to evaluate a range of cash flow impacts on the BVM industry: (1) the preservation of gross margin percentage scenario and (2) the preservation of operating profit. Under the preservation of gross margin percentage scenario, DOE applied a single uniform ''gross margin percentage'' across all efficiency levels. As MPCs increase with efficiency, this scenario implies that the absolute dollar markup will increase. DOE estimated gross margin percentages of 18 percent for Class A, 15 percent for Class B, 26 percent for Combo A, and 26 percent for Combo B.[65]

This manufacturer markup is the same as the one DOE assumed in the engineering analysis and the no-new-standards case of the GRIM. Because this scenario assumes that a manufacturer's absolute dollar markup would increase as MPCs increase in the standards cases, it represents the upper-bound to industry profitability under potential new energy conservation standards.

The preservation of operating profit scenario reflects manufacturers' concerns about their inability to maintain margins as MPCs increase to reach more stringent efficiency levels. In this scenario, while manufacturers make the necessary investments required to convert their facilities to produce compliant equipment, operating profit does not change in absolute dollars and decreases as a percentage of revenue.

Each of the modeled manufacturer markup scenarios results in a unique set of cash flows and corresponding industry values at each TSL. In the following discussion, the INPV results refer to the difference in industry value between the no-new-standards case and each standards case resulting from the sum of discounted cash flows from 2023 through 2057. To provide perspective on the short-run cash flow impact, DOE includes in the discussion of results a comparison of free cash flow between the no-new-standards case and the standards case at each TSL in the year before new standards are required.

TABLE V.17—MANUFACTURER IMPACT ANALYSIS FOR BVMS UNDER THE PRESERVATION OF GROSS MARGIN SCENARIO

	Units	No-new-standards case	Trial standard level*				
			1	2	3	4	5
INPV	*2021$ millions*	85.5	85.4	85.5	86.1	85.9	68.0
Change in INPV	*2021$ millions*		0.0	0.0	0.7	0.5	(17.5)
	%		0.0	0.0	0.8	0.6	(20.4)
Product Conversion Costs	*2021$ millions*		0.2	0.3	2.3	1.5	9.6
Capital Conversion Costs	*2021$ millions*		0.0	0.0	0.0	0.0	26.9
Total Investment Required**	*2021$ millions*		0.2	0.3	2.5	1.5	36.5

* Numbers in parentheses indicate a negative number.
** Numbers may not sum exactly due to rounding.

[65] This corresponds to manufacturer markups of 1.22 for Class A, 1.17 for Class B, and 1.36 for Combo A and B.

TABLE V.18—MANUFACTURER IMPACT ANALYSIS FOR BVMS UNDER THE PRESERVATION OF OPERATING PROFIT SCENARIO

	Units	No-new-standards case	Trial standard level*				
			1	2	3	4	5
INPV	*2021$ millions*	85.5	85.3	85.3	82.9	83.6	56.3
Change in INPV	*2021$ millions*		(0.2)	(0.2)	(2.5)	(1.9)	(29.2)
	%		(0.2)	(0.2)	(3.0)	(2.2)	(34.1)
Product Conversion Costs	*2021$ millions*		0.2	0.3	2.3	1.5	9.6
Capital Conversion Costs	*2021$ millions*		0.0	0.0	0.0	0.0	26.9
Total Investment Required**	*2021$ millions*		0.2	0.3	2.5	1.5	36.5

* Numbers in parentheses indicate a negative number.
** Numbers may not sum exactly due to rounding.

At TSL 5, DOE estimates that impacts on INPV would range from −$29.2 million to $17.5 million, or a change in INPV of −34.1 to −20.4 percent. At TSL 5, industry free cash flow is negative $8.6 million, which is a decrease of $15.4 million compared to the no-new-standards case value of $6.8 million in 2027, the year leading up to the proposed standards. Industry conversion costs total $36.5 million.

At TSL 5, the shipment-weighted-average MPC for BVMs increases by 21.4 percent relative to the no-new-standards case shipment-weighted-average MPC for all BVMs in 2030. Under both manufacurer markup scenarios, industry faces a drop in INPV. The reduction in INPV is driven by the high conversion costs. Product conversion costs could reach $9.6 million and capital conversion costs could reach $26.9 million. At this level, DOE expects that all equipment classes would require the use of VIPs for roughly half the cabinet surface area, the best available-efficiency variable-speed compressor, permanent magnet synchronous evaporator and condenser fan motors, microchannel condenser, refrigeration low power mode (per the DOE test procedure), and evaporator fan controls. The adoption of VIPs is the largest driver of conversion costs. Higher product conversion costs after typically needed to implement VIP designs, which are not found in BVMs today, for prototyping and testing for VIP placement, design, and sizing. Additionally, extensive incorporation of VIPs can require significant capital expenditures due to the need for more careful product handling and conveyor and investments in hard tooling for the VIP installation process. In the preservation of gross margin markup scenario, the increase in average MPC and corresponding increase in revenue is outweighed by the $36.5 million in conversion costs, resulting in a negative change in INPV at TSL 5.

Under the preservation of operating profit markup 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 21.4 percent shipment-weighted-average MPC increase results in a reduction in the manufacturer markup. This reduction in the manufacturer markup and the $36.5 million in conversion costs incurred by manufacturers cause a negative change in INPV at TSL 5 under the preservation of operating profit markup scenario.

At TSL 4, DOE estimates that impacts on INPV would range from −$1.9 million to $0.5 million, or a change in INPV of −2.2 to 0.6 percent. At TSL 4, industry free cash flow is $6.3 million, which is a decrease of $0.5 million compared to the no-new-standards case value of $6.8 million in 2027, the year leading up to the proposed standards. Industry conversion costs total $1.5 million.

At TSL 4, the shipment-weighted-average MPC for BVMs increases by 5.0 percent relative to the no-new-standards case shipment-weighted-average MPC for all BVMs in 2028. In the preservation of gross margin markup scenario, the increase in cash-flows from increased MSPs outweigh the upfront conversion investments manufacturers make and result in a slightly positive change in INPV at TSL 4.

Under the preservation of operating profit markup 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 5.0 percent shipment-weighted-average MPC increase results in a reduction in the manufacturer markup. This reduction in the manufacturer markup and the $1.5 million in conversion costs incurred by manufacturers cause a negative change in INPV at TSL 4 under the preservation of operating profit markup scenario.

At TSL 3, DOE estimates that impacts on INPV would range from −$3.0 million to $0.7 million, or a change in INPV of −3.0 to 0.8 percent. At TSL 3, industry free cash flow is $6.0 million, which is a decrease of $0.8 million compared to the no-new-standards case value of $6.8 million in 2027, the year leading up to the proposed standards. Industry conversion costs total $2.3 million.

At TSL 3, the shipment-weighted-average MPC for BVMs increases by 5.7 percent relative to the no-new-standards case shipment-weighted-average MPC for all BVMs in 2028. In the preservation of gross margin markup scenario, the increase in cash-flows from increased MSPs outweigh the upfront conversion investments manufacturers make and result in a slightly positive change in INPV at TSL 3.

Under the preservation of operating profit markup 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 5.7 percent shipment-weighted-average MPC increase results in a reduction in the manufacturer markup after the analyzed compliance year. This reduction in the manufacturer markup and the $2.3 million in conversion costs incurred by manufacturers cause a negative change in INPV at TSL 3 under the preservation of operating profit markup scenario.

At TSL 2, DOE estimates that impacts on INPV would range from −$0.2 million to $0.0 million, or a change in INPV of −0.2 to 0.0 percent. At TSL 2, industry free cash flow is $6.7 million, which is a decrease of $0.1 million compared to the no-new-standards case value of $6.8 million in 2027, the year leading up to the proposed standards. Industry conversion costs total $0.3 million.

At TSL 2, the shipment-weighted-average MPC for BVMs is anticipated to increase by less than 1 percent relative to the no-new-standards case shipment-weighted-average MPC for all BVMs in

2028. In the preservation of gross margin markup scenario, the increase in cash-flows from increased MSPs outweigh the limited conversion investments manufacturers make and result in a slightly positive change in INPV at TSL 2.

Under the preservation of operating profit markup 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 slight shipment-weighted-average MPC increase results in a reduction in the manufacturer markup after the analyzed compliance year. This reduction in the manufacturer markup and the $0.3 million in conversion costs incurred by manufacturers cause a negative change in INPV at TSL 2 under the preservation of operating profit markup scenario.

At TSL 1, DOE estimates that impacts on INPV would range from −$0.2 million to $0.0, or a change in INPV of −0.2 to 0.0 percent. At TSL 1, industry free cash flow is $6.7 million, which is a decrease of $0.1 million compared to the no-new-standards case value of $6.8 million in 2027, the year leading up to the proposed standards. Industry conversion costs total $0.2 million.

At TSL 1, the shipment-weighted-average MPC for BVMs increases by less than 1 percent relative to the no-new-standards case shipment-weighted-average MPC for all BVMs in 2028. In the preservation of gross margin markup scenario, the increase in cash-flows from increased MSPs outweigh the mild conversion investments manufacturers make and result in a slightly positive change in INPV at TSL 1.

Under the preservation of operating profit markup 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 slight shipment-weighted-average MPC increase results in a reduction in the manufacturer markup after the analyzed compliance year. This reduction in the manufacturer markup and the $0.2 million in conversion costs incurred by manufacturers cause a slightly negative change in INPV at TSL 1 under the preservation of operating profit markup scenario.

b. Direct Impacts on Employment

To quantitatively assess the potential impacts of amended energy conservation standards on direct employment in the BVM 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. 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*[66] 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[67] 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 70 percent of BVMs are produced domestically.

The domestic production employees estimate covers production line workers, including line supervisors, who are directly involved in fabricating and assembling equipment within the OEM facility. Workers performing services that are closely associated with production operations, such as materials handling tasks using forklifts, are also included as production labor. DOE's estimates only account for production workers who manufacture the specific equipment covered by this proposed rulemaking.

Non-production employees 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.

Direct employment is the sum of domestic production employees and non-production employees. Using the GRIM, DOE estimates in the absence of new energy conservation standards there would be 448 domestic employees for BVMs in 2028. Table V.19 shows the range of the impacts of energy conservation standards on U.S. manufacturing employment in the BVMs industry. The following discussion provides a qualitative evaluation of the range of potential impacts presented in Table V.19.

TABLE V.19—DOMESTIC DIRECT EMPLOYMENT IMPACTS FOR BEVERAGE VENDING MACHINE MANUFACTURERS IN 2028

	No-new-standards case	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Direct Employment in 2028	468	469	470	465	463	464
Potential Changes in Direct Employment Workers in 2028 *		(65) to 1	(65) to 2	(64) to (3)	(65) to (5)	(64) to (4)

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

[66] U.S. Census Bureau, *Annual Survey of Manufactures.* ''Summary Statistics for Industry Groups and Industries in the U.S (2021).'' Available at *https://www.census.gov/programs-surveys/asm/data.html* (Last accessed February 24, 2023).

[67] U.S. Bureau of Labor Statistics. *Industries at a Glance.* Available at *https://www.bls.gov/iag/tgs/iag333.htm.* Last accessed February 24, 2023.

The direct employment impacts shown in Table V.19 represent the potential domestic employment changes that could result following the compliance date for the BVM product classes in this proposal. Employment could increase or decrease due to the labor content of the various equipment being manufactured domestically. The upper bound estimate corresponds to an change in the number of domestic workers that would result from amended energy conservation standards if manufacturers continue to produce the same scope of covered equipment within the United States after compliance takes effect. The lower bound estimate represents the maximum decrease in production workers. In interviews, manufacturers raised concerns that their customers purchasing Class B equipment would shift toward purchasing Class A equipment if the prices of Class B equipment increased and approached the cost of Class A equipment. To establish a lower bound, DOE assumes a loss of direct employment commensurate with a potential loss of Class B shipments.

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 they have experience incorporating many of the design options that DOE considers in its engineering analysis. However, manufacturers noted that a few design options could lead to design and production challenges. In particular, manufacturers raised concerns about microchannel heat exchangers, vacuum insulated glass, and vacuum insulated panels. For microchannel exchangers, manufacturers were dubious about the performance gain from the design option and raised concerns about further performance issues in the field due to fouling of the channels. For vacuum insulated glass, manufacturers noted that prototypes did not provide the expected performance gains and the design option is not incorporated into any models today. For VIPs, manufacturers noted that they did not incorporate the design option into any models today. They noted that VIPs have a negative impact on the flow of foam within panels and reduce the overall rigidity of the cabinet. Manufacturers expected large investment to incorporate VIPs into their product design and to update production lines. With VIPs in particular, manufacturers were concerned about the engineering resources and level of investment required to redesign equipment to meet EPA refrigerant regulations by 2025 and again to meet amended standards in 2028.

d. Impacts on Subgroups of Manufacturers

Using average cost assumptions to develop industry cash-flow estimates may not capture the differential impacts among subgroups of manufacturers. Small manufacturers, niche players, or manufacturers exhibiting a cost structure that differs substantially from the industry average could be affected disproportionately. DOE investigated small businesses as a manufacturer subgroup that could be disproportionally impacted by energy conservation standards and could merit additional analysis. DOE did not identify any other adversely impacted manufacturer subgroups for this rulemaking based on the results of the industry characterization.

DOE analyzes the impacts on small businesses in a separate analysis in section VI.B of this document as part of the Regulatory Flexibility Analysis. 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 equipment. For these reasons, DOE conducts an analysis of cumulative regulatory burden as part of its rulemakings pertaining to appliance efficiency.

Some BVM manufacturers also produce commercial refrigeration equipment (CRE). DOE published a CRE ECS preliminary analysis on June of 2022. (87 FR 38296). There is not yet a proposed or finalized amended standard. If DOE proposes or finalizes any energy conservation standards for CRE prior to finalizing amended energy conservation standards for BVMs, DOE will add CRE into its consideration of cumulative regulatory burden for the BVM final rule.

DOE notes that there is cumulative regulatory burden due to product-specific, Federal regulation from another agency that occurs within 3 years of the proposed compliance date for an amended standard. The U.S. Environmental Protection Agency (EPA) proposed refrigerant restrictions pursuant to the AIM Act[68] in a NOPR published on December 15, 2022 (''December 2022 EPA NOPR''). 87 FR 76738. Specifically, EPA proposed prohibitions for new vending machines (EPA's term for this equipment) for the use of HFCs and blends containing HFCs that have a GWP of 150 or greater. 87 FR 76780. The proposal would prohibit manufacture or import of such vending machines starting January 1, 2025, and would ban sale, distribution, purchase, receive, or export of such vending machines starting January 1, 2026. 87 FR 76740. In the engineering analysis, DOE considered the use of alternative refrigerants that are not prohibited for BVM equipment in the December 2022 EPA NOPR. DOE understands that adapting product lines to meet the current and upcoming refrigerant regulations requires significant development and testing time. In particular, DOE understands that switching from non-flammable to flammable refrigerants (*e.g.,* R–290) requires time and investment to redesign BVM models and upgrade production facilities to accommodate the additional structural and safety precautions required. As discussed in section IV.C.1 of this document, DOE anticipates BVM manufacturers transitioning all models to R–290 to comply with anticipated refrigeration regulations, such as the December 2022

[68] Under subsection (i) of the AIM Act, entitled ''Technology Transitions,'' the EPA may by rule restrict the use of hydrofluorocarbons (HFCs) in sectors or subsectors where they are used. A person or entity may also petition EPA to promulgate such a rule. ''H.R.133—116th Congress (2019–2020): Consolidated Appropriations Act, 2021.'' *Congress.gov*, Library of Congress, 27 December 2020, *www.congress.gov/bill/116thcongress/house-bill/133.*

EPA NOPR,[69] prior to the expected 2028 compliance date of potential energy conservation standards. Therefore, the engineering analysis assumes the use of R–290 compressors as a baseline design option for all equipment classes. See section IV.C.1 of this document for additional information on refrigerant assumptions in the engineering analysis. DOE accounted for the costs associated with redesigning BVMs to make use of flammable refrigerants and upgrading production facilities to accommodate flammable refrigerants in the GRIM under the assumption that three manufacturers of BVMs have yet to make the R–290 transition. These costs are modeled as an impact to industry cashflow. DOE relied on manufacturer feedback in confidential interviews and a report prepared for the EPA [70] to estimate the industry refrigerant transition costs. See section V.B.2.e of this document and chapter 12 of the NOPR TSD for additional discussion on cumulative regulatory burden.

DOE requests information regarding the impact of cumulative regulatory burden on manufacturers of BVMs 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 national energy savings 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 BVMs, 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 equipment purchased in the 30-year period that begins in the year of anticipated compliance with amended standards (2028–2057). Table V.20 presents DOE's projections of the NES for each TSL considered for BVMs. The savings were calculated using the approach described in section IV.H of this document.

TABLE V.20—CUMULATIVE NATIONAL ENERGY SAVINGS FOR BEVERAGE VENDING MACHINES; 30 YEARS OF SHIPMENTS
[2028–2057]

Discount rate	Trial standard level				
	1	2	3	4	5
	quads				
Primary energy	0.04	0.05	0.08	0.09	0.13
FFC energy	0.04	0.06	0.09	0.09	0.14

OMB Circular A–4 [71] 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 proposed 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.[72] The review timeframe established in EPCA is generally not synchronized with the product lifetime, product manufacturing cycles, or other factors specific to BVMs. 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.21. The impacts are counted over the lifetime of BVMs purchased in 2028–2035.

TABLE V.21—CUMULATIVE NATIONAL ENERGY SAVINGS FOR REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINES; 9 YEARS OF SHIPMENTS
[2028–2035]

Discount rate	Trial standard level				
	1	2	3	4	5
	quads				
Primary energy	0.01	0.02	0.03	0.03	0.04
FFC energy	0.01	0.02	0.03	0.03	0.04

[69] The proposed rule was published on December 15, 2022. 87 FR 76738.

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

[71] U.S. Office of Management and Budget. *Circular A–4: Regulatory Analysis.* September 17, 2003. *obamawhitehouse.archives.gov/omb/circulars_a004_a-4* (last accessed January 2023).

[72] 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.

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 BVMs. In accordance with OMB's guidelines on regulatory analysis,[73] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V.22 shows the consumer NPV results with impacts counted over the lifetime of products purchased in 2028–2057.

TABLE V.22—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINES; 30 YEARS OF SHIPMENTS

[2028–2057]

Discount rate	Trial standard level				
	1	2	3	4	5
	billion 2021$				
3 percent	0.16	0.22	0.23	0.25	(0.31)
7 percent	0.07	0.09	0.08	0.09	(0.23)

The NPV results based on the aforementioned 9-year analytical period are presented in Table V.23. The impacts are counted over the lifetime of products purchased in 2028–2035. As mentioned previously, such results are presented for informational purposes only and are not indicative of any change in DOE's analytical methodology or decision criteria.

TABLE V.23—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINES; 9 YEARS OF SHIPMENTS

[2028–2035]

Discount rate	Trial standard level				
	1	2	3	4	5
	billion 2021$				
3 percent	0.07	0.09	0.07	0.07	(0.17)
7 percent	0.04	0.05	0.03	0.03	(0.14)

The previous results reflect the use of a default trend to estimate the change in price for BVMs over the analysis period (see section IV.H 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 BVMs 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 (2028–2032), in which these uncertainties are reduced.

The results suggest that the proposed amended 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 IV.C.1.b of this document, DOE has tentatively concluded that the standards proposed in this NOPR would not lessen the utility or performance of the BVMs 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

[73] U.S. Office of Management and Budget. *Circular A–4: Regulatory Analysis.* September 17, 2003. *obamawhitehouse.archives.gov/omb/circulars_a004_a-4* (last accessed February 2023).

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. 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 proposed rulemaking.

Energy conservation resulting from potential energy conservation standards for BVMs is expected to yield environmental benefits in the form of reduced emissions of certain air pollutants and GHGs. Table V.24 provides DOE's estimate of cumulative emissions reductions expected to result from the TSLs considered in this proposed rulemaking. The emissions were calculated using the multipliers discussed in section IV.K of this document. DOE reports annual emissions reductions for each TSL in chapter 13 of the NOPR TSD.

TABLE V.24—CUMULATIVE EMISSIONS REDUCTION FOR REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINES SHIPPED IN 2028–2057 *

	Trial standard level				
	1	2	3	4	5
Power Sector Emissions					
CO_2 (*million metric tons*)	1.26	1.73	2.65	2.83	1.26
CH_4 (*thousand tons*)	0.10	0.13	0.21	0.22	0.10
N_2O (*thousand tons*)	0.01	0.02	0.03	0.03	0.01
NO_X (*thousand tons*)	0.63	0.86	1.32	1.41	0.63
SO_2 (*thousand tons*)	0.60	0.82	1.27	1.35	0.60
Hg (*tons*)	0.004	0.005	0.008	0.009	0.004
Upstream Emissions					
CO_2 (*million metric tons*)	0.10	0.13	0.21	0.22	0.10
CH_4 (*thousand tons*)	9.20	12.65	19.42	20.72	9.20
N_2O (*thousand tons*)	0.00	0.00	0.00	0.00	0.00
NO_X (*thousand tons*)	1.47	2.02	3.11	3.32	1.47
SO_2 (*thousand tons*)	0.01	0.01	0.01	0.02	0.01
Hg (*tons*)	0.00001	0.00002	0.00003	0.00003	0.00001
CO_2 (*million metric tons*)	1.35	1.86	2.86	3.05	1.35
CH_4 (*thousand tons*)	9.29	12.78	19.63	20.93	9.29
N_2O (*thousand tons*)	0.01	0.02	0.03	0.03	0.01
NO_X (*thousand tons*)	2.10	2.89	4.43	4.73	2.10
SO_2 (*thousand tons*)	0.61	0.83	1.28	1.36	0.61
Hg (*tons*)	0.004	0.005	0.008	0.01	0.004

* Negative values refer to an increase in emissions.

As part of the analysis for this proposed 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 BVMs. Section IV.L of this document discusses the SC–CO_2 values that DOE used. Table V.25 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.25—PRESENT VALUE OF CO_2 EMISSIONS REDUCTION FOR REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINES SHIPPED IN 2028–2057

TSL	SC–CO_2 Case			
	Discount rate and statistics			
	5% Average	3% Average	2.5% Average	3% 95th percentile
	million 2021$			
1	12	53	83	161
2	17	73	115	222
3	25	112	176	340
4	27	120	188	363
5	40	178	280	541

As discussed in section IV.L.2 of this document, DOE estimated the climate benefits likely to result from the reduced emissions of CH_4 and N_2O that DOE estimated for each of the considered TSLs for BVMs. Table V.26 presents the value of the CH_4 emissions reduction at each TSL, and Table V.27 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.26—PRESENT VALUE OF METHANE EMISSIONS REDUCTION FOR REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINES SHIPPED IN 2028–2057

TSL	SC–CH_4 Case			
	Discount rate and statistics			
	5% Average	3% Average	2.5% Average	3% 95th percentile
	million 2021$			
1	3	10	14	27
2	4	14	19	36
3	7	22	30	57
4	8	23	33	62
5	12	35	50	93

TABLE V.27—PRESENT VALUE OF NITROUS OXIDE EMISSIONS REDUCTION FOR REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINES SHIPPED IN 2028–2057

TSL	SC–N_2O Case			
	Discount rate and statistics			
	5% Average	3% Average	2.5% Average	3% 95th percentile
	million 2021$			
1	0.04	0.17	0.26	0.45
2	0.06	0.23	0.35	0.61
3	0.09	0.36	0.56	0.96
4	0.10	0.39	0.61	1.05
5	0.14	0.59	0.92	1.58

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 BVMs. The dollar-per-ton values that DOE used are discussed in section IV.L of this document. Table V.28 presents the present value for NO_X emissions reduction for each TSL calculated using 7-percent and 3-percent discount rates, and Table V.29 presents similar results for SO_2 emissions reductions. The results in these tables reflect the 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.28—PRESENT VALUE OF NO_X EMISSIONS REDUCTION FOR REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINES SHIPPED IN 2028–2057

TSL	3% Discount rate	7% Discount rate
	million 2021$	
1	88	33
2	121	46
3	185	70
4	197	75
5	294	111

TABLE V.29—PRESENT VALUE OF SO_2 EMISSIONS REDUCTION FOR REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINES SHIPPED IN 2028–2057

TSL	3% Discount rate	7% Discount rate
	million 2021$	
1	34	13
2	47	18
3	72	28
4	76	29
5	114	44

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 direct PM and other co-pollutants may be significant. DOE has not included monetary benefits of the reduction of Hg emissions because the amount of reduction is very small.

7. Other Factors

The Secretary of Energy, in determining whether a standard is economically justified, may consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VII)). No other factors were considered in this analysis.

8. Summary of Economic Impacts

Table V.30 presents the NPV values that result from adding the estimates of the potential economic benefits resulting from reduced GHG, NO_X, and SO_2 emissions to the NPV of consumer benefits calculated for each TSL considered in this proposed rulemaking. The consumer benefits are domestic U.S. monetary savings that occur as a result of purchasing the covered equipment, and are measured for the lifetime of products shipped in 2028–2057. 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 BVMs shipped in 2028–2057.

TABLE V.30—CONSUMER NPV COMBINED WITH PRESENT VALUE OF CLIMATE BENEFITS AND HEALTH BENEFITS

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Using 3% discount rate for Consumer NPV and Health Benefits (billion 2021$)					
5% average SC–GHG case	0.30	0.41	0.52	0.56	0.15
3% average SC–GHG case	0.35	0.47	0.62	0.66	0.31
2.5% average SC–GHG case	0.38	0.52	0.70	0.74	0.43
3% 95th percentile SC–GHG case	0.47	0.65	0.89	0.95	0.74
Using 7% discount rate for Consumer NPV and Health Benefits (billion 2021$)					
5% average SC–GHG case	0.13	0.18	0.21	0.23	(0.02)
3% average SC–GHG case	0.18	0.24	0.31	0.33	0.14
2.5% average SC–GHG case	0.21	0.29	0.39	0.41	0.26
3% 95th percentile SC–GHG case	0.30	0.41	0.58	0.62	0.56

C. Conclusion

When considering new or amended energy conservation standards, the standards that DOE adopts for any type (or class) of covered equipment 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 BVMs at each TSL, beginning with the max-tech level, to determine whether that level was economically justified. Where the max-tech level was not justified, DOE then considered the next most efficient level and undertook the same evaluation until it reached the highest efficiency level that is both technologically feasible and economically justified and saves a significant amount of energy.

To aid the reader as DOE discusses the benefits and/or burdens of each TSL, tables in this section present a summary of the results of DOE's quantitative analysis for each TSL. In addition to the quantitative results presented in the tables, DOE also considers other burdens and benefits that affect economic justification. These include the impacts on identifiable subgroups of consumers who may be disproportionately affected by a national standard and impacts on employment.

1. Benefits and Burdens of TSLs Considered for BVM Standards

Table V.31 and Table V.32 summarize the quantitative impacts estimated for each TSL for BVMs. The national impacts are measured over the lifetime of BVMs purchased in the 30-year period that begins in the anticipated year of compliance with amended standards (2028–2057). The energy savings, emissions reductions, and value of emissions reductions refer to FFC results. The efficiency levels contained in each TSL are described in section V.A of this document.

TABLE V.31—SUMMARY OF ANALYTICAL RESULTS FOR REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINE TSLs: NATIONAL IMPACTS

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Cumulative FFC National Energy Savings					
Quads	0.04	0.056	0.086	0.092	0.14
Cumulative FFC Emissions Reduction					
CO_2 (*million metric tons*)	1.4	1.9	2.9	3.0	4.5
CH_4 (*thousand tons*)	9	13	20	21	31
N_2O (*thousand tons*)	0.01	0.02	0.03	0.03	0.05
NO_X (*thousand tons*)	2.1	2.9	4.4	4.7	7.1
SO_2 (*thousand tons*)	0.6	0.8	1.3	1.4	2.0
Hg (*tons*)	0.004	0.005	0.008	0.009	0.013
Present Value of Benefits and Costs (3% discount rate, billion 2021$)					
Consumer Operating Cost Savings	0.17	0.24	0.32	0.33	0.47
Climate Benefits *	0.06	0.09	0.13	0.14	0.21
Health Benefits **	0.12	0.17	0.26	0.27	0.41
Total Benefits †	0.36	0.49	0.71	0.75	1.09
Consumer Incremental Product Costs ‡	0.01	0.02	0.08	0.08	0.78
Consumer Net Benefits	0.16	0.22	0.23	0.25	(0.31)
Total Net Benefits	0.35	0.47	0.62	0.66	0.31
Present Value of Benefits and Costs (7% discount rate, billion 2021$)					
Consumer Operating Cost Savings	0.07	0.10	0.13	0.14	0.19
Climate Benefits *	0.06	0.09	0.13	0.14	0.21
Health Benefits **	0.05	0.06	0.10	0.10	0.15
Total Benefits †	0.18	0.25	0.36	0.38	0.56
Consumer Incremental Product Costs ‡	0.00	0.01	0.05	0.05	0.42
Consumer Net Benefits	0.07	0.09	0.08	0.09	(0.23)
Total Net Benefits	0.18	0.24	0.31	0.33	0.14

Note: This table presents the costs and benefits associated with automatic commercial ice makers shipped in 2028–2057. These results include benefits to consumers that accrue after 2057 from the products shipped in 2028–2057.

* Climate benefits are calculated using four different estimates of the SC–CO_2, SC–CH_4, and SC–N_2O. Together, these represent the global SC–GHG. For presentational purposes of this table, the climate benefits associated with the average SC–GHG at a 3-percent discount rate are shown; however, DOE emphasizes the importance and value of considering the benefits calculated using all four sets of SC–GHG estimates. To monetize the benefits of reducing GHG emissions, this analysis uses the interim estimates presented in the *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990* published in February 2021 by the IWG.

** Health benefits are calculated using benefit per ton values for NO_X and SO_2. DOE is currently only monetizing (for NO_X and SO_2) $PM_{2.5}$ precursor health benefits and (for NO_X) ozone precursor health benefits, but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions. The health benefits are presented at real discount rates of 3 and 7 percent. See section IV.L of this document for more details.

† Total and net benefits include consumer, climate, and health benefits. For presentation purposes, total and net benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate, but DOE does not have a single central SC–GHG point estimate. DOE emphasizes the importance and value of considering the benefits calculated using all four sets of SC–GHG estimates.

‡ Costs include incremental equipment costs.

TABLE V.32 SUMMARY OF ANALYTICAL RESULTS FOR REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINE TSLs: MANUFACTURER AND CONSUMER IMPACTS

Category	TSL 1*	TSL 2*	TSL 3*	TSL 4*	TSL 5*
Manufacturer Impacts					
Industry NPV (*million 2021$*) (No-new-standards case INPV = 85.5)	85.3 to 85.4	85.3 to 85.5	82.9 to 86.1	83.6 to 85.9	56.3 to 68.0
Industry NPV *(% change)*	(0.2) to 0	(0.2) to 0	(3.0) to 0.8	(2.2) to 0.6	(34.1) to (20.4)
Consumer Average LCC Savings (2021$)					
Class A	$150	$203	$99	($6)	($823)
Class B	$167	$212	$117	$198	($280)
Combo A	$212	$263	$89	$207	($851)
Combo B	$214	$310	$37	$239	($245)
Shipment-Weighted-Average*	$166	$220	$98	$92	($625)
Consumer Simple PBP (years)					
Class A	0.5	0.7	4.0	5.7	23.5
Class B	0.6	0.7	3.6	1.4	10.5

TABLE V.32 SUMMARY OF ANALYTICAL RESULTS FOR REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINE TSLS: MANUFACTURER AND CONSUMER IMPACTS—Continued

Category	TSL 1*	TSL 2*	TSL 3*	TSL 4*	TSL 5*
Combo A	0.4	0.5	3.8	1.4	19.5
Combo B	0.4	0.9	5.1	2.2	10.9
Shipment-Weighted-Average *	0.5	0.7	4.0	3.8	18.5
Percent of Consumers that Experience a Net Cost					
Class A	0%	0%	28%	59%	94%
Class B	0	0	24	4	88
Combo A	0	0	41	3	99
Combo B	0	0	53	0	85
Shipment-Weighted-Average *	0	0	30	33	92

* Weighted by shares of each product class in total projected shipments in 2028.

DOE first considered TSL 5, which represents the max-tech efficiency levels. At this level DOE expects that all equipment classes would represent EL7, which would require VIPs, variable-speed compressors, permanent magnet synchronous evaporator and condenser fan motors, microchannel condensers, refrigeration low power modes (tested in accordance to the DOE test procedure), and evaporator fan controls for all equipment classes. Further, DOE expects that Class A and Combination A machines would require automatic lighting controls (tested in accordance to the DOE test procedure) and vacuum insulated glass doors. TSL 5 would save an estimated 0.14 quads of energy, an amount DOE considers significant. Under TSL 5, the NPV of consumer benefit would be -$0.23 billion using a discount rate of 7 percent, and -$0.31 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 5 are 4.5 Mt of CO_2, 2.0 thousand tons of SO_2, 7.1 thousand tons of NO_X, 0.013 tons of Hg, 31 thousand tons of CH_4, and 0.05 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 $0.21 billion. The estimated monetary value of the health benefits from reduced SO_2 and NO_X emissions at TSL 5 is $0.15 billion using a 7-percent discount rate and $0.41 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 $0.14 billion. Using a 3-percent discount rate for all benefits and costs, the estimated total NPV at TSL 5 is $0.31 billion. The estimated total NPV is provided for additional information; however, DOE primarily relies upon the NPV of consumer benefits when determining whether a proposed standard level is economically justified.

At TSL 5, the shipment weighted average LCC impact for an affected consumer is a cost of $532. The average LCC impact for Class A is a cost of $695, a cost of $199 for Class B, a cost of $851 for Combo A, and a cost of $239 for Combo B. The average simple payback period is 18.3 years for Class A, 9.2 years for Class B, 19.5 years for Combo A, and 10.9 years for Combo B. The shipment-weighted average simple payback period for all equipment classes is 15.2 years. The fraction of consumers experiencing a net LCC cost is 93 percent for Class A, 84 percent for Class B, 99 percent for Combo A, 85 percent for Combo B. The shipment weighted average fraction of consumers experiencing a net cost is 90 percent across all BVM equipment classes.

At TSL 5, the projected change in INPV ranges from a decrease of $29.2 million to a decrease of $17.5 million, which corresponds to decreases of 34.1 percent and 20.4 percent, respectively. DOE estimates that industry must invest $36.5 million to comply with standards set at TSL 5. There are five BVM manufacturers that manufacture equipment covered by this rulemaking. None of the five BVM manufacturers offers models that meet the efficiency level required at TSL 5 for BVMs in any product class. DOE expects manufacturers to adopt vacuum insulated panels at TSL 5. The use of vacuum insulated panels would require manufacturers to redesign their equipment offerings and invest heavily in new cabinet fixtures, significantly increasing conversion costs.

The Secretary tentatively concludes that at TSL 5 for BVMs, the benefits of energy savings, emission reductions, and the estimated monetary value of the emissions reductions would be outweighed by the negative NPV of consumer benefits and the economic burden on many consumers, as well as the impacts on manufacturers, including the large conversion costs, profit margin impacts that could result in a large reduction in INPV, and the lack of manufacturers currently offering products meeting the efficiency levels required at this TSL, including most small businesses. A majority of BVM consumers (90 percent) would experience a net cost and the average LCC savings would be negative (-$532). The potential reduction in INPV could be as high as 34.1 percent. Additionally, no BVM manufacturer offers models that meet the efficiency level required at TSL 5 for BVMs covered by this rulemaking. Consequently, the Secretary has tentatively concluded that TSL 5 is not economically justified.

DOE then considered TSL 4, which represents EL6 for Class A, EL4 for Class B, EL4 for Combo A, and EL5 for Combo B. At these efficiency levels, DOE expects that all equipment classes would require improved-efficiency evaporator and condenser fan motors (in many cases ECMs or permanent magnet synchronous motors), refrigeration low power modes (tested in accordance to the DOE test procedure), and evaporator fan controls. Further, DOE expects that Class A machines would require automatic lighting controls (tested in accordance to the DOE test procedure), variable-speed compressors, and microchannel condensers; Combination A machines would require automatic lighting controls (tested in accordance to the DOE test procedure); and Combination B machines would require microchannel condensers. TSL 4 would save an estimated 0.09 quads of energy, an amount DOE considers significant. Under TSL 4, the NPV of consumer benefit would be $0.09 billion using a discount rate of 7 percent, and $0.25

billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 4 are 3.0 Mt of CO_2, 1.4 thousand tons of SO_2, 4.7 thousand tons of NO_X, 0.009 tons of Hg, 21 thousand tons of CH_4, and 0.03 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 $0.14 billion. The estimated monetary value of the health benefits from reduced SO_2 and NO_X emissions at TSL 4 is $0.10 billion using a 7-percent discount rate and $0.27 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 $0.33 billion. Using a 3-percent discount rate for all benefits and costs, the estimated total NPV at TSL 4 is $0.66 billion. The estimated total NPV is provided for additional information; however, DOE primarily relies upon the NPV of consumer benefits when determining whether a proposed standard level is economically justified.

At TSL 4, the shipment weighted average LCC impact is a savings of $97. The average LCC impact for Class A is a cost of $5.52, a savings of $206 for Class B, savings of $190 for Combo A, and savings of $287 for Combo B. The simple payback period is 5.7 years for Class A, 1.2 years for Class B, 1.4 years for Combo A and 2.2 years for combo B. The shipment weighted average simple payback period for all BVMs is 3.7 years. The fraction of consumers experiencing a net LCC cost is 59 percent for Class A, 2 percent for Class B, 12 percent for Combo A and 0 percent for Combo B. The shipment weighted average fraction of consumers experiencing a net LCC cost is 34 percent.

At TSL 4, the projected change in INPV ranges from a decrease of $1.9 million to an increase of $0.5 million, which correspond to a decrease of 2.2 percent and an increase of 0.6 percent, respectively. DOE estimates that industry must invest $1.5 million to comply with standards set at TSL 4. None of the 5 BVM manufacturers currently offer models that meet the efficiency level required at TSL 4 for BVMs in any product class. At TSL 5, the primary driver of high conversion costs is the industry's investment to redesign both products and production lines for the introduction of vacuum insulated panels. TSL 4 does not require the incorporation of vacuum insulated panels, which in turn reduces the need for redesigned models and new cabinet fixtures. This reduces both the level of potential capital investment and the engineering effort required to redesign equipment. At TSL 4, the primary driver of conversion costs is the industry's investment to redesign products for the incorporation of variable speed compressors, more efficient evaporators and fan motors, and, for PC 1, triple pane glass packs.

After considering the analysis and weighing the benefits and burdens, the Secretary has tentatively concluded that at a standard set at TSL 4 for BVMs is economically justified. At this TSL, the average LCC savings for BVM consumers across all equipment classes is positive with 34 percent of consumers negatively impacted. The NPV of consumer benefits is positive at each equipment class at both 3-percent and 7-percent discount rates. Further, TSL 4 represents the maximum NPV of consumer benefits out of all TSLs at a 3-percent discount rate. The shipment weighted average LCC impact is a positive savings of $97 at TSL 4, including a cost of $6 for Class A BVMs. This $6 cost represents 0.06 percent of the average LCC for the equipment ($9,551). Further, the LCC calculations are based on equipment to be installed on the compliance year of the proposed rule. However, the costs for higher efficiency PMS fan motors as well as for variable speed compressors which may be incorporated in the manufacture of Class A BVMs at TSL 4 is projected to drop quickly in subsequent years, shifting the small negative LCC for Class A to a positive value quickly and resulting in both consumer LCC benefits and overall net consumer NPV benefits (see discussion of equipment price trends in Chapter 8 of the NOPR TSD). Approximately 7% of the installed cost to the customer for Class A equipment at TSL 4 ($4,228 shown in Table V.4) are expected to be in components which DOE anticipates to experience experiential learning price drops of approximately 5.9% year over year. Thus by year 2 of the rule the expected cost reduction in Class A is approximately $17 at TSL 4. The anticipated market in the no new standards case has approximately 95 percent of the market at EL3 and below and these basecase efficiency equipment would not experience similar component-level experiential learning. Thus DOE predicts an average reduction in the incremental installed cost for Class A equipment by year 2 of the rule of approximately $16.40 over the no-new standards case. Assuming equipment installed in year 2 will have similar energy benefits to equipment installed in year 1 over the no new standards case, the reduction in first cost for equipment installed in year 2 will more than offset the small negative $6 LCC savings shown for year 1 of the rule. DOE recognizes that the fraction of consumers of Class A equipment in the compliance year is negative is more than one-half of the affected customers, but similarly believes that this will change within a short few years into the analysis period for the reasons previously illustrated. Given that Class A NPVs are strongly positive at both 3-percent and 7-percent discount rates, DOE has determined that the small LCC cost for Class A in TSL 4 in year one of the analysis period did not outweigh the NPV benefits that would accrue to consumers over the analysis period. Thus, DOE has determined that TSL 4 would be economically justified.

The FFC national energy savings are significant and the NPV of consumer benefits is positive using both a 3-percent and 7-percent discount rate. Notably, the benefits to consumers vastly outweigh the cost to manufacturers. At TSL 4, the NPV of consumer benefits, even measured at the more conservative discount rate of 7 percent is over 40 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 $0.14 billion in climate benefits (associated with the average SC–GHG at a 3-percent discount rate), and $0.27 billion (using a 3-percent discount rate) or $0.10 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 while TSL 5 would provide for over 50% higher energy savings and significantly greater climate and health benefits from emission reductions than TSL 4, the consumer net benefits at TSL 5 are negative whereas those at TSL 4 are positive. Further both the consumer net benefits and the total net benefits, including the monetized benefits from emission reductions, at TSL 4 exceed those at TSL 5 as well as those of the other TSLs examined by DOE. When comparing TSL 4 to TSL 3, DOE notes that the shipment weighted average LCC savings for TSL 4 is less than at TSL 3 by $10, but the shipment weighted average PBP at TSL 4 of 3.7 years, is lower than TSL 3, at 3.8 years. At TSL 4, the shipment weighted average fraction of customers experiencing a net LCC cost is 34 percent, only slightly greater than the 28 percent estimated for TSL 3. Taken as a whole for the BVM market, the LCC and payback impact on consumers at TSL 3 and TSL 4 are very similar. The consumer net benefits at TSL 4 exceed those of TSL 3 due to the energy savings and the total net benefits including monetized benefits of emission reductions. These additional savings and benefits at TSL 4 are significant. Thus, DOE considers the impacts to be, as a whole, economically justified at TSL 4.

Although DOE considered proposed amended standard levels for BVMs by grouping the efficiency levels for each equipment class into TSLs, DOE evaluates all analyzed efficiency levels in its analysis. For all equipment classes except Class A, TSL 4 represents the maximum TSL that results in LCC savings and for these classes less than 5 percent of the consumers experience an LCC cost. For Class A, the average LCC savings was -$6 over the life of the equipment and 59% of consumers experience negative LCC savings. As noted previously however, the average LCC cost is small relative to the life-cycle cost of Class A equipment and the expected reduction in cost of specific components used for Class A at TSL 4 including variable speed compressors and permanent magnet synchronous fan motors is anticipated to change the incremental equipment costs such that the small LCC cost experienced by Class A purchasers in the compliance year will not be experienced in subsequent years. Although DOE acknowledges the negative LCC impacts seen in Class A, given that the weighted average LCC benefits across all classes are positive at TSL 4, DOE has tentatively determined that TSL 4 is economically justified.

Therefore, based on the previous considerations, DOE proposes to adopt the energy conservation standards for BVMs at TSL 4. The proposed amended energy conservation standards for BVMs, which are expressed as kWh/day, are shown in Table V.33.

TABLE V.33—PROPOSED AMENDED ENERGY CONSERVATION STANDARDS FOR REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINES

Equipment class	Maximum daily energy consumption kilowatt hours per day
Class A	$0.029 \times V^* + 1.34$
Class B	$0.029 \times V^* + 1.21$
Combination A	$0.048 \times V^* + 1.50$
Combination B	$0.052 \times V^* + 0.96$

* V is the representative value of refrigerated volume (ft^3) of the BVM model, as calculated pursuant to 10 CFR 429.52(a)(3).

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.34 shows the annualized values for BVMs 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 BVMs is $5.8 million per year in increased equipment costs, while the estimated annual benefits are $16 million from reduced equipment operating costs, $8.5 million from GHG reductions, and $12 million from reduced NO_X and SO_2 emissions. In this case, the net benefit amounts to $30 million per year.

Using a 3-percent discount rate for all benefits and costs, the estimated cost of the proposed standards for BVMs is $4.9 million per year in increased equipment costs, while the estimated annual benefits are $20 million in reduced operating costs, $8.5 million from GHG reductions, and $16 million from reduced NO_X and SO_2 emissions. In this case, the net benefit amounts to $39 million per year.

TABLE V.34—ANNUALIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINES (TSL 4)

	Million 2021$/year		
	Primary estimate	Low net benefits estimate	High net benefits estimate
3% discount rate			
Consumer Operating Cost Savings	20	19	20
Climate Benefits *	8.5	8.5	8.5
Health Benefits **	16	16	17
Total Benefits †	44	44	45
Consumer Incremental Product Costs ‡	4.9	5.2	4.9
Net Benefits	39	38	40
7% discount rate			
Consumer Operating Cost Savings	16	15	16
Climate Benefits * (3% discount rate)	8.5	8.5	8.5
Health Benefits **	12	12	12
Total Benefits †	36	35	36
Consumer Incremental Product Costs ‡	5.8	6.0	5.7

TABLE V.34—ANNUALIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINES (TSL 4)—Continued

	Million 2021$/year		
	Primary estimate	Low net benefits estimate	High net benefits estimate
Net Benefits	30	29	31

Note: This table presents the costs and benefits associated with BVMs shipped in 2028 – 2057. These results include benefits to consumers which accrue after 2057 from the products shipped in 2028 – 2057. 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 sections IV.F.1 and IV.H.3 of this document. Note that the Benefits and Costs may not sum to the Net Benefits due to rounding.

* Climate benefits are calculated using four different estimates of the global SC–GHG (see section IV.L of this document). For presentational purposes of this table, the climate benefits associated with the average SC–GHG at a 3-percent discount rate are shown, but DOE does not have a single central SC–GHG point estimate, and it emphasizes the importance and value of considering the benefits calculated using all four sets of SC–GHG estimates. 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. In the absence of further intervening court orders, DOE will revert to its approach prior to the injunction and presents monetized 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 benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate, but DOE does not have a single central SC–GHG point estimate.

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

D. Reporting, Certification, and Sampling Plan

Manufacturers, including importers, must use product-specific certification templates to certify compliance to DOE. For BVM equipment, the certification template reflects the general certification requirements specified at 10 CFR 429.12 and the product-specific requirements specified at 10 CFR 429.52. DOE is not proposing to amend the product-specific certification requirements for this equipment.

VI. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866, 13563, and 14094

Executive Order (''E.O.'') 12866, ''Regulatory Planning and Review,'' as supplemented and reaffirmed by E.O. 13563, ''Improving Regulation and Regulatory Review,'' 76 FR 3821 (Jan. 21, 2011) and E.O. 14094, ''Modernizing Regulatory Review,'' 88 FR 21879 (April 11, 2023), requires agencies, to the extent permitted by law, to (1) propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public. DOE emphasizes as well that E.O. 13563 requires agencies to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible. In its guidance, the Office of Information and Regulatory Affairs (OIRA) in the OMB has emphasized that such techniques may include identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes. For the reasons stated in the preamble, this proposed regulatory action is consistent with these principles.

Section 6(a) of E.O. 12866 also requires agencies to submit ''significant regulatory actions'' to OIRA for review. OIRA has determined that this final regulatory action does not constitute a ''significant regulatory action'' within the scope of section 3(f) of E.O. 12866. Accordingly, this action was not submitted to OIRA for review under E.O. 12866.

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 equipment that is the subject of this proposed rulemaking.

For manufacturers of BVMs, the SBA has set a size threshold, which defines those entities classified as ''small businesses'' for the purposes of the statute. DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule; see 13 CFR part 121. The size standards are listed by North American Industry Classification System (NAICS) code and industry description and are available at *www.sba.gov/document/support--table-size-standards.* Manufacturing of BVMs is classified under NAICS 333310, ''Commercial and Service Industry Machinery Manufacturing.'' The SBA sets a threshold of 1,000 employees or fewer for an entity to be considered as a small business for this category.

1. Description of Reasons Why Action Is Being Considered

DOE is proposing amended energy conservation standards for BVMs. EPCA directed DOE to prescribe energy conservation standards for BVMs not later than 4 years after August 8, 2005. (42 U.S.C. 6295(v)(1)) DOE has completed this proposed rulemaking. 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 proposed rulemaking is in accordance with DOE's obligations under EPCA.

2. Objectives of, and Legal Basis for, Rule

DOE is conducting this proposed rulemaking to fulfill its statutory obligation under EPCA to 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 not later than 6 years after the issuance of any final rule establishing or amending a standard. (42 U.S.C. 6295(m)(1)) DOE must follow specific statutory criteria for prescribing new or amended standards for covered products, including BVMs. Specifically, any new or amended standard for a covered product must be designed to achieve the maximum improvement in energy efficiency that the Secretary of Energy determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A) and 42 U.S.C. 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)(B))

3. Description on Estimated Number of Small Entities Regulated

To estimate the number of companies that could be small business manufacturers of products covered by this proposed rulemaking, DOE conducted a market survey using public information and subscription-based company reports to identify potential small manufacturers. DOE's research involved DOE's Compliance Certification Database (CCD),[74] California Energy Commission's Modernized Appliance Efficiency Database System directory,[75] individual company websites, and market research tools (*e.g.,* reports from Dun & Bradstreet[76]) to create a list of companies that manufacture, produce, import, or assemble the products covered by this rulemaking. DOE also asked stakeholders and industry representatives if they were aware of any other small manufacturers during manufacturer interviews and at DOE public meetings. 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 identified five OEMs of BVMs sold in the United States. Of the five OEMs, DOE identified two small, domestic manufacturers affected by proposed amended standards for BVM equipment. The first small business is an OEM of Class A, Class B, and Combo A equipment. The second small business is an OEM of Class B, Combo A, and Combo B equipment.

DOE reached out to these small businesses and invited them to participate in voluntary interviews. DOE also requested information about small businesses and potential impacts on small businesses while interviewing large manufacturers.

DOE requests comment on the number of small, domestic OEMs in the industry.

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

The first small business is an OEM that certifies ten basic models of Class A BVMs, two basic models of Class B BVMs, and eight basic models of Combo A BVMs. One of the 20 basic models would meet the proposed amended standards. In total, the company would need to redesign 19 basic models.

DOE estimated the first small business would need to invest $800,000 in product conversion costs to redesign all 19 basic models. DOE's engineering analysis indicates manufacturers would be able to produce compliant products on existing production lines with minimal capital investments. DOE's estimate of the product conversion costs is based on feedback from manufacturers, which indicated they would need to invest in redesigning Class A, Class B, and Combo A products to incorporate design options such as variable speed compressors, more efficient motors, larger heat exchangers, variable speed compressors, and triple pane glass packs. DOE estimated the cost of this redesign per model, and multiplied that cost by the number of models that would need to be redesigned by the first small business. DOE's analysis focused on the investments associated with amended standards; investments associated with changes in regulations by other Federal agencies (*i.e.,* refrigerant regulations) are not attributed to amended standards. Based on market research tools, DOE estimated the company's annual revenue to be $27 million. Taking into account the three-year conversion period, DOE expects conversion costs to be 1.0% of conversion period revenue.

The second small business is an OEM that certifies one basic model of Class B BVMs, five basic models of Combo A BVMs, and one basic model of Combo B BVMs. None of the company's BVM models would meet the proposed amended standards. In total, the company would need to redesign seven basic models.

DOE estimated the company would need to invest $100,000 in product conversion costs to redesign all seven basic models. DOE's estimate of the product conversion costs is based on feedback from manufacturers, which indicated they would need to invest in redesigning Class B, Combo A, and Combo B products to incorporate design options such as variable speed compressors, more efficient motors, larger heat exchangers, and variable speed compressors. DOE estimated the cost of this redesign per model, and multiplied that cost by the number of models that would need to be redesigned by the second small business. DOE's engineering analysis design options suggest manufacturers would be able to produce compliant products on existing production lines with minimal capital investments.

[74] See *www.regulations.doe.gov/certification-data/CCMS–4-Refrigerated_Bottled_or_Canned_Beverage_Vending_Machines.html#q=Product_Group_s%3A%22Refrigerated%20Bottled%20or%20Canned%20Beverage%20Vending%20Machines%22.* (Accessed February 9, 2023).

[75] *California Energy Commission, Modernized Appliance Efficiency Database System.* (Last accessed September 30, 2022.) *cacertappliances.energy.ca.gov/Pages/Search/AdvancedSearch.aspx.*

[76] The Dun & Bradstreet Hoovers login is available at *app.dnbhoovers.com.*

DOE's analysis focused on the investments associated with amended standards; investments associated with changes in regulations by other Federal agencies (*i.e.,* refrigerant regulations) are not attributed to amended standards. Based on market research tools, DOE estimated the company's annual revenue to be $72 million. Taking into account the three-year conversion period, DOE expects conversion costs to be 0.1% of conversion period revenue.

DOE requests comment on the potential impacts of the proposed standard on small business manufacturing of BVMs, including the extent of model redesign and manufacturing lines changes necessitated by standards.

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 this 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, they would come at the expense of a reduction in energy savings. TSL 1 achieves 56 percent lower energy savings compared to the energy savings at TSL 4. TSL 2 achieves 39 percent lower energy savings compared to the energy savings at TSL 4. TSL 3 achieves 6 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 BVM 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 BVM equipment must certify to DOE that their equipment comply with any applicable energy conservation standards. In certifying compliance, manufacturers must test their products according to the DOE test procedures for BVM equipment, 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 BVM equipment. (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. The 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 proposed rulemaking qualifies for categorical exclusion B5.1 because it is a rulemaking that establishes energy conservation standards for consumer products or industrial equipment, none of the exceptions identified in categorical exclusion B5.1(b) apply, no extraordinary circumstances exist that require further environmental analysis, and it otherwise meets the requirements for application of a categorical exclusion; *see* 10 CFR 1021.410. DOE will complete its NEPA review before issuing the final rule.

E. Review Under Executive Order 13132

E.O. 13132, ''Federalism,'' 64 FR 43255 (Aug. 10, 1999), imposes certain requirements on Federal agencies formulating and implementing policies or regulations that preempt State law or that have federalism implications. The Executive order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE has examined this proposed rule and has tentatively determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the equipment that is 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 E.O. 13132.

F. Review Under Executive Order 12988

With respect to the review of existing regulations and the promulgation of new regulations, section 3(a) of E.O. 12988, ''Civil Justice Reform,'' imposes on Federal agencies the general duty to adhere to the following requirements: (1) eliminate drafting errors and ambiguity, (2) write regulations to minimize litigation, (3) provide a clear legal standard for affected conduct rather than a general standard, and (4) promote simplification and burden reduction. 61 FR 4729 (Feb. 7, 1996). Regarding the review required by section 3(a), section 3(b) of E.O. 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation (1) clearly specifies the preemptive effect, if any, (2) clearly specifies any effect on existing Federal law or regulation, (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction, (4) specifies the retroactive effect, if any, (5) adequately defines key terms, and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of E.O. 12988 requires Executive agencies to review regulations in light of applicable standards in section 3(a) and section 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, this proposed rule meets the relevant standards of E.O. 12988.

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA) requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Public Law 104–4, section 201 (codified at 2 U.S.C. 1531). For a 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 *energy.gov/sites/prod/files/gcprod/documents/umra_97.pdf.*

This rule does not contain a Federal intergovernmental mandate, nor is it expected to require expenditures of $100 million or more in any one year by the private sector. As a result, the analytical requirements of UMRA do not apply.

H. Review Under the Treasury and General Government Appropriations Act, 1999

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

I. Review Under Executive Order 12630

Pursuant to E.O. 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights,'' 53 FR 8859 (Mar. 15, 1988), DOE has determined that this proposed rule would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

J. Review Under the Treasury and General Government Appropriations Act, 2001

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 note) provides for Federal agencies to review most disseminations of information to the public under information quality guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). Pursuant to OMB Memorandum M–19–15, Improving Implementation of the Information Quality Act (April 24, 2019), DOE published updated guidelines, which are available at *www.energy.gov/sites/prod/files/2019/12/f70/DOE%20Final%20Updated%20IQA%20Guidelines%20Dec%202019.pdf.* DOE has reviewed this NOPR under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

K. Review Under Executive Order 13211

E.O. 13211, ''Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use,'' 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OIRA at OMB a Statement of Energy Effects for any proposed significant energy action. A ''significant energy action'' is defined as any action by an agency that promulgates or is expected to lead to promulgation of a final rule, and that (1) is a significant regulatory action under E.O. 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (3) is designated by the Administrator of OIRA as a significant energy action. For any 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 BVM equipment, 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 Federal 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.[77] Generation of this report involved a

[77] The 2007 Energy Conservation Standards Rulemaking Peer Review Report is available at the following website: *www.energy.gov/eere/buildings/downloads/energy-conservation-standards-rulemaking-peer-review-report-0.* Last accessed Feb. 13, 2023.

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 DOE's analyses. DOE is in the process of evaluating the resulting report.[78]

VII. Public Participation

A. Participation in the Webinar

The time and date of the webinar meeting are listed in the **DATES** section at the beginning of this document. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website: *www.energy.gov/eere/buildings/public-meetings-and-comment-deadlines.* Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Prepared General Statements for Distribution

Any person who has an interest in the topics addressed in this proposed rule, or who is representative of a group or class of persons that has an interest in these issues, may request an opportunity to make an oral presentation at the webinar. Such persons may submit a request to *ApplianceStandardsQuestions@ee.doe.gov.* Persons who wish to speak should include with their request a computer file in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format that briefly describes the nature of their interest in this proposed rulemaking and the topics they wish to discuss. Such persons should also provide a daytime telephone number where they can be reached.

C. Conduct of the Webinar

DOE will designate a DOE official to preside at the webinar and may also use a professional facilitator to aid discussion. The meeting will not be a judicial or evidentiary-type public hearing, but DOE will conduct it in accordance with section 336 of EPCA (42 U.S.C. 6306). A court reporter will be present to record the proceedings and prepare a transcript. DOE reserves the right to schedule the order of presentations and to establish the procedures governing the conduct of the webinar. There shall not be discussion of proprietary information, costs or prices, market share, or other commercial matters regulated by U.S. antitrust laws. After the webinar and until the end of the comment period, interested parties may submit further comments on the proceedings and any aspect of the proposed rulemaking.

The webinar will be conducted in an informal, conference style. DOE will conduct a general overview of the topics addressed in this proposed rulemaking, allow time for prepared general statements by participants, and encourage all interested parties to share their views on issues affecting this proposed rulemaking. Each participant will be allowed to make a general statement (within time limits determined by DOE), before the discussion of specific topics. DOE will permit, as time permits, other participants to comment briefly on any general statements.

At the end of all prepared statements on a topic, DOE will permit participants to clarify their statements briefly. Participants should be prepared to answer questions by DOE and by other participants concerning these issues. DOE representatives may also ask questions of participants concerning other matters relevant to this proposed rulemaking. The official conducting the webinar will accept additional comments or questions from those attending, as time permits. The presiding official will announce any further procedural rules or modification of the above procedures that may be needed for the proper conduct of the webinar.

A transcript of the webinar will be included in the docket, which can be viewed as described in the *Docket* section at the beginning of this document. 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

[78] The report is available at *www.nationalacademies.org/our-work/review-of-methods-for-setting-building-and-equipment-performance-standards.*

contact information in a cover letter. Include your first and last names, email address, telephone number, and optional mailing address. The cover letter will not be publicly viewable as long as it does not include any comments.

Include contact information each time you submit comments, data, documents, and other information to DOE. No telefacsimiles (''faxes'') will be accepted.

Comments, data, and other information submitted to DOE electronically should be provided in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format. Provide documents that are not secured, that are written in English, and that are free of any defects or viruses. Documents should not contain special characters or any form of encryption and, if possible, they should carry the electronic signature of the author.

Campaign form letters. Please submit campaign form letters by the originating organization in batches of between 50 to 500 form letters per PDF or as one form letter with a list of supporters' names compiled into one or more PDFs. This reduces comment processing and posting time.

Confidential Business Information. Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email to *BVM2020STD0014@ee.doe.gov* 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 revise the definition of Combination A.

(2) DOE requests comments on its proposal to use baseline levels for BVM equipment based upon the design changes made by manufacturers in response to the December 2022 EPA NOPR.

(3) DOE further requests comment on its estimates of energy use reduction associated with the design changes made by manufacturers in response to the December 2022 EPA NOPR.

(4) DOE request comments on the frequency and nature of compressor and motor repairs or replacements in BVMs.

(5) DOE seeks comment on the method for estimating manufacturing production costs.

(6) DOE requests comment on how to address the climate benefits and other non-monetized effects of the proposal.

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

(8) DOE requests comment on the number of small, domestic OEMs in the industry.

(9) DOE requests comment on the potential impacts of the proposed standard on small business manufacturing of BVMs, including the extent of model redesign and manufacturing lines changes necessitated by standards.

Additionally, DOE welcomes comments on other issues relevant to the conduct of this proposed rulemaking that may not specifically be identified in this document.

VIII. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this notice of proposed rulemaking and announcement of public meeting.

List of Subjects in 10 CFR Part 431

Administrative practice and procedure, Confidential business information, Energy conservation test procedures, Reporting and recordkeeping requirements.

Signing Authority

This document of the Department of Energy was signed on May 1, 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 May 5, 2023.

Treena V. Garrett,

Federal Register Liaison Officer, U.S. Department of Energy.

For the reasons set forth in the preamble, DOE proposes to amend part 431 of chapter II, subchapter D, of title 10 of the Code of Federal Regulations, as set forth below:

PART 431—ENERGY EFFICIENCY PROGRAM FOR CERTAIN COMMERCIAL AND INDUSTRIAL EQUIPMENT

■ 1. The authority citation for part 431 continues to read as follows:

Authority: 42 U.S.C. 6291–6317; 28 U.S.C. 2461 note.

■ 2. Amend § 431.292 by revising the definition of ''Combination A'' to read as follows:

§ 431.292 Definitions concerning refrigerated bottled or canned beverage vending machines.

* * * * *

Combination A means a combination vending machine where 25 percent or more of the surface area on the front side of the beverage vending machine that surrounds the refrigerated compartment(s) is transparent.

* * * * *

■ 3. Revise § 431.296 to read as follows:

§ 431.296 Energy conservation standards and their effective dates.

(a) Each refrigerated bottled or canned beverage vending machine manufactured on or after January 8, 2019 and before [*date 3 years after date of publication of final rule in the* ***Federal Register***], shall have a daily energy consumption (in kilowatt hours per day), when measured in accordance with the DOE test procedure at § 431.294, that does not exceed the following:

Equipment class	Maximum daily energy consumption (kilowatt hours per day)
Class A	0.052 × V† + 2.43.
Class B	0.052 × V† + 2.20.
Combination A	0.086 × V† + 2.66.
Combination B	0.111 × V† + 2.04.

† "V" is the representative value of refrigerated volume (ft^3) of the BVM model, as calculated pursuant to 10 CFR 429.52(a)(3).

(b) Each refrigerated bottled or canned beverage vending machine manufactured on or after [*date 3 years after date of publication of final rule in the* ***Federal Register***], shall have a daily energy consumption (in kilowatt hours per day), when measured in accordance with the DOE test procedure at § 431.294, that does not exceed the following:

Equipment class	Maximum daily energy consumption (kilowatt hours per day)
Class A	0.029 × V† + 1.34.
Class B	0.029 × V† + 1.21.
Combination A	0.048 × V† + 1.50.
Combination B	0.052 × V† + 0.96.

† "V" is the representative value of refrigerated volume (ft^3) of the BVM model, as calculated pursuant to 10 CFR 429.52(a)(3).

[FR Doc. 2023–09968 Filed 5–24–23; 8:45 am]

BILLING CODE 6450–01–P